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VOL. CXXXVI.—No. 3526] LONDON: FRIDAY EVENING, JULY 27, 1923 [PRICE {WITH INDEX AND OTHER SUPPLEMENT} 1s. 6D. BY INLAND POST 1s. 9d.

The Engineer

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The Building of Omnibus Bodies (With a Two-Page Supplement).

The Manufacture of Spun Iron Pipes.

Electricity in Mines—No. I.

Reconditioning St. James's Park Lake (No. II).

Corrosion in Sea Water.

The "Never-Stop" Train System.

The Cable Ship Faraday.

Dangers of Sulphuretted Hydrogen.

PUBLIC NOTICES

The Director-General, India Store Department, Branch No. 18, Belvedere-road, Lambeth, S.E. 1. REQUIRES :—
1. LOCOMOTIVE ENGINES AND TENDERS.
2. WHEELS, CHILLED CAST IRON.
Tenders due on the 24th August, 1923.
Tender forms obtainable from above. 3140

R.E. STORES AND MATERIALS.

Tenders are Invited for the PURCHASE of 7800 YARDS FLANGED RAILS, 80 lb. per yard, complete with POINTS and CROSSINGS and FISH-PLATES complete; 134 SLEEPERS and 400 FIR LOGS used for sleepers and crossing timbers; also 100 TONS of FIREWOOD, lying at Codford Railway Station, Camp Siding.
Particulars and Tender forms, also permission to inspect, to be obtained from
THE ROADS AND COMMUNICATIONS OFFICER, Southern Command,
Evelyn House, Wilton-road,
3126 Salisbury.

Assistant Engineer Re- QUIRED by the GOVERNMENT of NIGERIA, PUBLIC WORKS DEPARTMENT, for two tours of not less than 12 nor more than 18 months' continuous residential service. Salary £480, rising to £720 by annual increments of £30, and thence to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment. Liberal leave in England on full salary. Free quarters and passages. Candidates, aged 25 to 30, preferably unmarried, must have had a good general education and (a) be A.M.I.C.E. or hold equivalent professional qualifications, or (b) have passed the full examination of the Institution of Municipal and County Engineers. They must have had proper technical training and have had not less than two years' subsequent experience on large engineering or municipal works.—Apply at once, by letter, stating age, qualifications, and experience, whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, S.W. 1, quoting M/12,031. 3166

Department of Scientific AND INDUSTRIAL RESEARCH.
A RESEARCH ENGINEER is REQUIRED to Take Charge of the Building Research Board's Experimental Station, East Acton, W. Candidates should be honours graduates in civil engineering or possess equivalent qualifications, with some practical experience. Importance will be attached to experience in research in building materials and construction.
Preference will be given, other things being equal, to ex-Service men.
Salary will be of the order of £450 per annum inclusive, according to qualifications and experience.
Applications, giving particulars of age, qualifications, military service, and enclosing copies of testimonials or names of referees, should be made in writing not later than 20th August, 1923, to SECRETARY, Department of Scientific and Industrial Research, 16, Old Queen-street, S.W. 1. 3165

Executive Engineer, Grade III., REQUIRED by the GOVERNMENT of the GOLD COAST, PUBLIC WORKS DEPARTMENT, for two tours of not less than 12 nor more than 18 months' continuous residential service, with possible extension. Salary £480, rising by annual increments of £30 to £720 a year, and thence to £920 by annual increments of £40. Outfit allowance of £60 on first appointment. Liberal leave in England on full salary. Free quarters and passages. Candidates, under 35, preferably single, must be qualified civil engineers with special experience in roads, buildings and public works.—Apply at once by letter, stating age, whether married or single, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W., quoting M/12,136. 3173

Clyde Navigation.
TO ROAD AND BRIDGE CONTRACTORS.
The Trustees of the Clyde Navigation invite TENDERS for the CONSTRUCTION of about 2000 LINEAL YARDS of MAIN ROAD, including the LAYING of TRAMWAYS thereon, forming a Diversion of the Renfrew-road between Maxwell-road, Shieldhall, and Millburn Bridge, Renfrew, with THREE REINFORCED CONCRETE BRIDGES, carrying the new road over existing and intended lines of railway.
The drawings may be seen and specification, schedule of quantities and form of Tender obtained on and after Friday, 27th curt., by application to the Trustees' Engineer, at his office here, on deposit of Five Guineas, which will be returned on receipt of a bona fide Tender.
An Assistant Engineer will be in attendance at Maxwell-road, Shieldhall, at 10 a.m. on Wednesday, 1st August, to point out to intending offerers the location of the works.
Sealed Tenders, marked "Tender for Renfrew Road Diversion," are to be lodged with the undersigned not later than Noon on Monday, 20th August.
The Trustees do not bind themselves to accept the lowest or any Tender, and they reserve power to divide the work into two or more separate contracts to different contractors.
T. R. MACKENZIE,
General Manager and Secretary.
16, Robertson-street, Glasgow,
24th July, 1923. 3144

Metropolitan Water Board.
PROVISION OF 7-TON STEAM CRANE.
LEA BRIDGE, CLAPTON, N.E.
The Metropolitan Water Board invite TENDERS for the SUPPLY, TESTING, and SETTING to WORK of a STEAM-DRIVEN LOCOMOTIVE SHUNTING JIB CRANE of 7 tons capacity at their Lea Bridge Pumping Station.
Forms of Tender and conditions of contract may be obtained on and after Saturday, 21st July, 1923, from the Chief Engineer, New River Head, 173, Rosebery-avenue, E.C. 1, by personal application (Room 135) or upon forwarding a stamped addressed brief envelope.
Tenders, enclosed in sealed envelopes, addressed to "The Clerk of the Board, Metropolitan Water Board, New River Head, 173, Rosebery-avenue, E.C. 1," and endorsed "Tender for Crane," must be delivered at the Offices of the Board not later than 11 a.m. on Friday, 10th August, 1923.
The Board do not bind themselves to accept the lowest or any Tender.
G. F. STRINGER,
Clerk of the Board.
Offices of the Board,
New River Head,
173, Rosebery-avenue, E.C. 1.
20th July, 1923. 3141

PUBLIC NOTICES

County of London.
The London County Council invites TENDERS for the MANUFACTURE, SUPPLY, DELIVERY, ERECTION, TESTING, and MAINTENANCE of MACHINE TOOLS for the Council's Tramway Central Repair Depot, Charlton, London, S.E.
The specification and drawings, form of Tender, and other particulars may be obtained from the General Manager, London County Council Tramways, Victoria Embankment, W.C. 2, upon payment of a deposit of £2. This amount will be returnable only if a bona fide Tender is submitted and not withdrawn.
Particulars of the work may be obtained at the Tramway Offices, Victoria Embankment, before the payment of the deposit.
Tenderers may submit a Tender for all or any of the machines enumerated in the specification and schedule, and the Council reserves the right to accept any Tender as regards all or any of the items, but does not bind itself to accept any Tender in whole or in part.
Tenders must be addressed to the Clerk of the Council and delivered at the County Hall, Westminster Bridge, S.E. 1, not later than 4 p.m. on Monday, 17th September, 1923. No Tender received after that time will be considered.
JAMES BIRD,
3120 Clerk of the London County Council.

County of London.
The London County Council invites TENDERS for PIPING, VALVES, &c., for the Northern Outfall Works, East Ham, E. 6 (alongside Beckton Gasworks).
Persons desiring to submit Tenders may obtain, on and after Monday, 30th July, 1923, the drawings, specification, form of Tender, &c., on application to the Chief Engineer at the Old County Hall, Spring-gardens, S.W. 1, upon payment of the sum of £2. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the drawings, specification and other contract documents may be inspected at the Old County Hall before payment of the fee.
No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 13th August, 1923, will be considered.
The Council does not bind itself to accept the lowest or any Tender.
JAMES BIRD,
3167 Clerk of the London County Council.

State Electricity Commission OF VICTORIA.
TENDERS FOR PLANT.
TENDERS are hereby INVITED for the SUPPLY, DELIVERY, &c., of the following for the Morwell Power Scheme.
Copies of Tender form and specification will be available upon application to :—
Agent-General for Victoria,
Melbourne-place, Strand,
London, W.C. 2.
SPECIFICATION NO. 23/117.—22,000-VOLT INSULATORS.
CHARGE.—£2 2s. for the first three copies of Tender form, conditions of contract, specification complete. These charges will be returned on receipt of a bona fide Tender. A fourth copy and any further copies will be supplied for the sum of 10s. 6d. each.
PRELIMINARY DEPOSIT.—A preliminary deposit of £50 is to be lodged with the Tender.
The specification may be inspected at the above-mentioned office.
The Commission does not bind itself to accept the lowest or any Tender.
Tenders, on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than Noon on 6th October, 1923.
R. LIDDELOW,
Secretary,
State Electricity Commission of Victoria,
Melbourne, Victoria,
3074 Australia.

PUBLIC NOTICES

Salford Board of Guardians.
UNION INFIRMARY, STOTT-LANE, PENDLETON, NEAR MANCHESTER.
The Guardians invite TENDERS for NEW LANCASHIRE BOILER, ECONOMISER, FEED PUMPS, STEAM and WATER PIPES, &c., in connection with the Laundry and Extensions to the Heating and Hot Water System at the Union Infirmary.
Drawing of the plant and detailed specification of the new boiler may be inspected at the offices of the Engineer, Mr. T. Roland Wollaston, M.I. Mech. E., Lord's Chambers, 26, Corporation-street, Manchester. Form of Tender, general specification and conditions of contract may be obtained from me on receipt of cheque for Two Guineas, which will be refunded upon receipt of bona fide Tender.
The Guardians do not bind themselves to accept the lowest or any Tender, and the selected contractor will be required to subscribe to the conditions as regards employment of labour, &c., as set forth in their regulations.
Sealed Tenders, endorsed "Engineering, Section 1," must be delivered at my offices not later than 10 a.m. on Saturday, August 4th, 1923.
By Order,
E. H. INCHLEY,
Clerk to the Guardians.
Poor Law Offices,
Eccles New-road, Salford,
17th July, 1923. 3078

The Great Indian Peninsula RAILWAY COMPANY.
The Directors are prepared to receive TENDERS for the SUPPLY of the following STORES, namely :—

	Fee for Specification.
CARRIAGE UNDERFRAMES with Four-wheel Bogies (66ft. over Headstock)	£1

Specifications and forms of Tender may be obtained at this office on payment of the fee for the specification, which payment will not be returned.
The fee should accompany any application by post. Cheques and postal orders should be crossed and made payable to the Great Indian Peninsula Railway Company.
Tenders must be delivered in SEPARATE ENVELOPES, sealed and addressed to the undersigned, marked "Tender for Carriage Underframes (66ft. over Headstock)," or as the case may be, not later than Eleven o'clock a.m. on Tuesday, the 14th August, 1923.
The Directors do not bind themselves to accept the lowest or any Tender.
R. H. WALPOLE,
Secretary.
Company's Offices,
48, Copthall-avenue, E.C. 2.
London, 23rd July, 1923. 3155

Irish Free State.
HAULBOWLINE DOCKYARD.
The Government of the Irish Free State are prepared to consider OFFERS for the LEASE of the above NAVAL DOCKYARD, situated at the entrance to Cork Harbour, and containing extensive wharf and warehouse accommodation with large dry dock and slipways. The yard is provided with 60-ton shear legs, travelling cranes, and well-equipped machine shops.
There are also Three 5000-Ton Oil Tanks and One 6000-Ton Oil Tank, which would be disposed of separately.
Specifications, drawings and particulars may be obtained from
J. F. CROWLEY and PARTNERS,
Consulting Engineers,
16, Victoria-street, Westminster.
Offers, which should indicate the employment that would be afforded, should reach the above not later than August 25th.
The Government do not bind themselves to accept the highest or any Offer. 3071

PUBLIC NOTICES

King's Lynn Conservancy BOARD.
The King's Lynn Conservancy Board invite TENDERS for DREDGING from 40,000 to 60,000 Cubic Yards (more or less) of Sand and Mud in the Ship Channel to King's Lynn in the Wash.
Copies of the specification and form of Tender can be obtained on application to the undersigned.
Further particulars can be obtained from Captain A. E. Holmes, Harbour Master, King's Lynn, or the Board's Engineer, Mr. E. J. Silcock, M. Inst. C.E., 25, Victoria-street, Westminster.
Sealed Tenders, endorsed "Dredging," should be delivered to the undersigned not later than first post on the 31st July, 1923.
The Board does not bind itself to accept the lowest or any Tender.
W. D. WARD,
Clerk to the Board.
King's Lynn,
20th July, 1923. 3128

Parish of Hammersmith.
TENDERS.
(a) STEAM COPPERS.
(b) FUEL ECONOMISER.
The Guardians of the Parish of Hammersmith invite TENDERS for the undermentioned WORK :—
(a) STEAM COPPERS IN KITCHEN.
SUPPLY TWO New TINNED COPPER PANS at the Special Surgical Hospital, Ducane-road, Shepherd's Bush, to fit existing copper, the approximate size of the pans being 25in. diameter and 23in. deep by 1-8in. thick, with bosses on to take the place of defective aluminium pans.
Existing cast iron cover to be altered and new Wrought Iron Ring and Copper Lid supplied.
Further particulars can be obtained by applying to the Master and Acting Quartermaster of the Hospital on any week-day (except Saturday) between the hours of 10 a.m. and 4 p.m. Forms of Tender, which will include the specification, may be obtained from the Guardians' Offices, 206, Goldhawk-road, W. 12.
(b) FUEL ECONOMISER.
(1) REPAIRING present FUEL ECONOMISER and putting same in thorough working order.
(2) SUPPLYING New FUEL ECONOMISER for heating feed water for three Lancashire boilers. Maximum quantity of water evaporated 900-1000 gallons per hour.
Further particulars can be obtained by applying to the Master and Acting Quartermaster at the Hospital on any week-day (except Saturday) between the hours of 10 a.m. and 4 p.m.
The estimates for (a) (1) and (2) must be accompanied by specifications of the work proposed, and the estimate must be separate and distinct in respect of repairing the present economiser and for supplying a new one.
All estimates must be delivered at my office in sealed envelopes, endorsed "Estimate for ——," no later than 10 a.m. on Tuesday, the 7th August, 1923.
The Guardians do not bind themselves to accept the lowest or any Tender.
By Order,
W. H. GLANVILLE,
Clerk to the Guardians.
Guardians' Offices,
206, Goldhawk-road, W. 12,
26th July, 1923. 3170

The Bengal and North-Western RAILWAY COMPANY, LIMITED.
The Directors are prepared to receive TENDERS for the SUPPLY of :—
101 TONS RED and WHITE LEAD, DRY,
as per specification to be seen at the Company's offices.
Tenders, addressed to the undersigned, and marked "Tender for Red and White Lead," with name of firm tendering, are to be lodged not later than Noon on Friday, the 10th day of August, 1923.
For each specification a fee of 10s. will be charged, which cannot under any circumstances be returned.
The Directors do not bind themselves to accept the lowest or any Tender.
By Order of the Board,
E. A. NEVILLE,
Managing Director.
237, Gresham House, Old Broad-street,
London, E.C. 2,
25th July, 1923. 3164

County of Surrey.
HIGHWAYS AND BRIDGES DEPARTMENT.
ARTERIAL ROADS.
APPLICATIONS are INVITED for the APPOINTMENT of TWO RESIDENT ENGINEERS, to act under the directions of the County Surveyor in the supervision of the construction of the proposed Kingston and Sutton By-pass Roads. Salary at the rate of £600 per annum.
Also for CLERKS of WORKS, to assist the Resident Engineers on the above-named works. Salary at the rate of £8 per week.
Applications, in writing, stating full particulars of appointments held and experience on similar works, accompanied by references, should reach the undersigned not later than Noon on Wednesday, the 8th August.
Forms of application and further particulars may be obtained from the undersigned.
W. P. ROBINSON,
County Surveyor.
County Hall, Kingston-on-Thames,
23rd July 1923. 3139

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PUBLIC NOTICES

Great Northern Railway (Ireland).

PERMANENT WAY MATERIALS.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

90 lb. R.B.S. BULLHEAD RAILS and FISH-PLATES for same ;
CAST IRON CHAIRS ; and
PERMANENT WAY FASTENINGS.

Specifications, drawings, and forms of Tender can be obtained from the Secretary.

Tenders, made out on the forms supplied by the Company, should be delivered, under sealed cover, endorsed "Tender for Rails, &c.," to the undersigned not later than 10 a.m. on Saturday, 18th August.

The Directors do not bind themselves to accept the lowest or any Tender

J. B. STEPHENS,
Secretary.

Secretary's Office,
Amiens-street Station, Dublin,
24th July, 1923. 3162

Urban District Council of Enfield.

The Council invite TENDERS for the SUPPLY and DELIVERY to their Sewage Works, Oakthorpe Hall-lane, Lower Edmonton, of a STANDARD VERTICAL BOILER of approximately 6 H.P. capacity, with two cross tubes, and suitable for a working pressure of 60 lb. per square inch.

The boiler is to be complete with all usual fittings and mountings, including mild steel chimney and damper, and is to be delivered within one month of the date of acceptance of Tender. The successful tenderer will be required to enter into a formal indenture of contract for the due fulfilment of same.

Sealed Tenders, endorsed "Tender for Boiler," and including complete specification of the boiler, are to be delivered to the undersigned not later than Twelve Noon on Monday, August 13th, 1923.

T. W. SCOTT,
Clerk to the Council.

Public Offices,
Enfield, Middlesex,
19th July, 1923. 3155

SITUATIONS OPEN

WANTED, Experienced FOUNDRY SUPERINTENDENT with Metallurgical Knowledge, by old-established General Engineering Company manufacturing light castings, steel, iron and malleable ; improving and permanent position for first-class man.—Address, with copies of two testimonials, stating age and salary requires, P7785, The Engineer Office. P7785 A

WANTED for Large Firm of Railway Rolling Stock Manufacturers, GENTLEMAN as REPRESENTATIVE for Birmingham and the Midlands. This is an excellent opening for a good man, who would be paid by salary and commission on orders obtained.—Address in the first instance, stating age, experience, and salary required, 3027, The Engineer Office. 3027 A

WANTED, TWO WATERWORKS ENGINEER'S ASSISTANTS. Public works experience essential, good surveyors, levellers, and draughtsmen. Apply, stating age, qualifications, experience, and salary required, to ENGINEER, Fylde Water Board, Blackpool. 3146 A

ASST. WORKS ENGINEER and DRAUGHTSMAN, for Shropshire, age 28-35. Accustomed to design, detail, and getting out specifications, quantities, and estimates for Steel, Timber and Concrete Structures, Machine, Ropeways, Conveyors, and Elevators.—Apply by letter, stating experience, age, and salary required, P7721, The Engineer Office. P7721 A

BRIDGE ERECTOR REQUIRED for a Period of 18 months in India. Candidates should be well experienced in the Erection of Bridges with native labour. Experience in the sinking of caissons an advantage.—Apply, stating age and salary required, enclosing copies of recent testimonials, to GENERAL MANAGER, Braithwaite and Co., Engineers, Ltd., West Bromwich. 3132 A

CARRON COMPANY REQUIRE the SERVICES of a SUPERINTENDING ENGINEER, to Take Charge of Works Construction, Upkeep of Buildings, Boilers and Machinery—other than Electrical Plant—at the Company's Works and Collieries and in connection with Steamers. The possession of a Board of Trade Chief Engineer's Certificate essential.—Applicants to state age, experience, and salary expected to MANAGER for CARRON COMPANY, Carron Works, Falkirk. 3153 A

CHIEF ESTIMATOR and RATE FIXER REQUIRED for large Engineering Works working on straight piecework system. Only those who have thoroughly up-to-date knowledge of manufacturing methods need apply.—Apply in own handwriting, giving age, salary expected, and at least two references, 3038, The Engineer Office. 3038 A

CITY OF HULL.—CIVIL ENGINEERING ASSISTANT REQUIRED in City Engineer's Department, at £275 per annum without bonus. The candidates to be associated members of the Inst. C.E. or Inst. M. and Cy. E., by examination, or to possess equivalent qualifications, and to have had experience in Structural Steel and Ferro-concrete Work. Testimonials and specifications not to be sent in the first instance.—Applications to reach the CITY ENGINEER, Hull, before 9th August, 1923. 3142 A

COLLIERY ENGINEER REQUIRED for Modern developing collieries ; energetic, good disciplinarian, accustomed to costings, checking consumption, materials and stores ; good opening for keen, resourceful man. State age, experience, salary required, and enclose copies of recent references.—Address, 3103, The Engineer Office. 3103 A

CONTINENTAL ENGINEERS REQUIRE JUNIOR ASSISTANT, fully experienced in Examining and Testing Steel Castings, Rolled Materials, also Structural Work. Write, stating experience, also salary required. Only qualified man taken.—Address P7779, The Engineer Office. P7779 A

ESTIMATOR REQUIRED for Government and Commercial Work at a large Engineering Works near London. Preference given to man with experience in Pattern-making and Moulding.—Address, stating age, experience, and salary required, 3149, The Engineer Office. 3149 A

REPRESENTATIVES on Liberal Commission Basis, able to introduce sale of High-class Lubricating Oils at competitive prices, REQUIRED throughout the country.—Address, 3054, The Engineer Office. 3054 A

REQUIRED, TECHNICAL SECRETARY to MANAGER ; Petrol Engine and General Engineering experience. Permanent position near London. Furnish details of experience, age, and salary required.—Address, 3159, The Engineer Office. 3159 A

STEAM POWER ENGINEER.—The Proprietors of Box No. P7699 A wish to thank all who replied to the advertisement appearing under the above heading in this magazine on July 6th, 1923, and give notice that the APPOINTMENT has now been FILLED. P7775 A

WANTED by Engineering Firm in the Midlands, a SENIOR DRAUGHTSMAN, fully experienced and accustomed to the Design and Detailing of all types of Elevators, Conveyors, Screens, Storage Hoppers, and general mechanical engineering requirements. State age, salary required, when at liberty, and give fullest details of experience.—Address, 3145, The Engineer Office. 3145 A

WANTED for a Steel Wagon Shop on the N.E. Coast, an experienced WAGON DRAUGHTSMAN ; must be capable of getting out expeditiously details for shops, sketchs and particulars for estimates. State age, experience, and salary required.—Address, 3060, The Engineer Office. 3060 A

SITUATIONS OPEN (continued)

CONSTRUCTIONAL DRAUGHTSMAN WANTED AT ONCE. Permanent if satisfactory. Must be quick and accurate detailer. Only those with previous experience need apply. State age, experience, salary required.—Address, 3157, The Engineer Office. 3157 A

DRAUGHTSMAN WANTED for London Office ; one having experience in the Mechanical Handling of Minerals an advantage. Must be quick and accurate worker. Good prospects for right man.—Address, giving age, outline of experience, and salary required, 3171, The Engineer Office. 3171 A

FIRST-CLASS DRAUGHTSMAN REQUIRED, thoroughly accustomed to Design of Mining and Concentration Plants.—Apply, giving particulars of age, experience, salary, &c., to FRASER and CHALMERS ENGINEERING WORKS, Erith, Kent 3160 A

JUNIOR STRUCTURAL DRAUGHTSMEN WANTED AT ONCE in London for Detailing Steel-frame Building. State wages, experience, and when at liberty.—Address, 3154, The Engineer Office. 3154 A

STRUCTURAL STEEL DRAUGHTSMAN REQUIRED in Eastern Counties. One accustomed to Preparation of Estimates and Detail Drawings.—Apply, stating age, experience, and salary required, and when able to take up duties, to Box 378, W. S. Crawford, Ltd., 233, High Holborn, London, W.C. 1. 3125 A

THE CHATWOOD SAFE COMPANY, Limited, Bolton, REQUIRE the SERVICES of a well-trained MECHANICAL DRAUGHTSMAN with initiative and proved designing ability.—Applications should be addressed to "CHIEF DESIGNER," stating age, experience, and salary required. P7787 A

FOUNDRY FOREMAN WANTED IMMEDIATELY, to take entire charge of the department.—Apply by letter, stating full particulars of experience, salary required, &c., to RANSOMES and RAPIER, Ltd., Waterside Works, Ipswich. 3170 A

SITUATIONS WANTED

A FIRST-CLASS CHEMIST, University Man, highly experienced petroleum and explosives, able to advise on construction problems or undertake research, is OPEN to ENGAGEMENT, home or abroad.—Address, LEWIS, 17, Bedford-place, W.C. P7773 B

A.M.I.C.E., 14 Years' First-class Experience, Including steel erection, steel and concrete buildings, heavy foundations, railway work, &c., WANTS POST, home or abroad. Fluent Spanish, used to organisation and control of labour. Could invest some capital after trial period, if desired.—Address, P7796, The Engineer Office. P7796 B

A.M.I.C.E. (32), Apprenticed Crewe Works, 2 Years B.O., 5 years assistant and chief of locomotive steam sheds, 3 years automobile and general engineering, estimates, specifications, commercial experience, DESIRES POST ; moderate salary.—Address, P7797, The Engineer Office. P7797 B

APPRENTICESHIP or PREMIUM PUPILAGE REQUIRED by Mech. Eng. Graduate (21), who has had 12 months' works experience ; Manchester district preferred, but not essential.—Address, P7800, The Engineer Office. P7800 B

EDUCATED YOUTH (18), Matric, Inter. Sc., DESIRES PRAC. EXP. in PATENT AGENT'S OFFICE where knowledge of chemistry and physics can be applied. Small prem. if req'd.—Address, 3123, The Engineer Office. 3123 B

ENGINEER (Working) SEEKS SITUATION ; Good all-round experience, fitting, turning, charge of plant ; 1st Class B.O.T. Certificate.—FRANKIS, 2, Riverdale-road, Twickenham, Middlesex. P7784 B

ENGINEER (28), General Experience and Sound theoretical knowledge, WANTS POST with prospects, home or abroad.—Address, P7786, The Engineer Office. P7786 B

ENGINEER (30), with Sound Theoretical and Practical training, highly experienced in motor car design and manufacture, DESIRES APPOINTMENT as Chief Engineer or Designer.—Address, P7793, The Engineer Office. P7793 B

ENGINEER (34) DESIRES POST, Assistant Works Manager or Engineer. Sound D.O. and general engineering experience, construction and plant layouts, furnaces, gas producers, chemical plant, works maintenance. Good organiser and used to control.—Address, P7776, The Engineer Office. P7776 B

ENGINEER SALESMAN, Having Connection amongst petrol engine manufacturers, would like to get in touch with a firm desiring REPRESENTATION.—Address, P7790, The Engineer Office. P7790 B

LOCOMOTIVE FITTER SEEKS RE-ENGAGEMENT ; eleven years' experience in railway running shed, also experience in steam heating.—S. G. G., 1, St. Paul's-avenue, Cricklewood, N.W. 2. 3156 B

MECHANICAL ENGINEER (24), 3 Years' Diploma, G.I.M.E., 4 years' practical experience motor and general engineering, D.O. experience, SEEKS SITUATION, home or abroad.—Address, P7775, The Engineer Office. P7775 B

MECH. ENGINEER (32), Served Time in well-known loco. shops ; studied at American University for B.Sc., last year interrupted by war ; varied shop and office exp. at home and abroad, SEEKS responsible POSITION ; willing to go anywhere.—Address, P7802, The Engineer Office. P7802 B

PATENT EXPERT (46), German Chartered Patent Agent and Dipl. Ing., good knowledge of engineering, several languages, 20 years' experience, 3 years in London before war, DESIRES SITUATION with British patent agent.—Address, P7778, The Engineer Office. P7778 B

WILL Anyone OFFER EMPLOYMENT to ENGINEER (35), who urgently requires same ? Good all-round marine, D.O., mechanical and electrical experience. Irreproachable testimonials, held responsible positions as works and chief engineer ; Extra First-class Eng., B.O.T.—M. EVERTON, Coleridge-road, Ashford, Middlesex. P7788 B

YOUNG CIVIL ENGINEER (20), B.Sc., DESIRES START with good firm, home or abroad.—Address, P7777, The Engineer Office. P7777 B

YOUNG MAN (24, Single), A.M.I. Inst. B., SEEKS POSITION as Junior Engineer or Draughtsman ; W. and D.O. exp., good technical education, knowledge of photographing machinery.—Address, P7799, The Engineer Office. P7799 B

DRAUGHTSMAN, Age 20½, with 4½ Years' Experience in D.O. and works on presses, moulds and rubber machinery, SEEKS an APPOINTMENT with a good engineering firm at home or abroad.—Address, P7794, The Engineer Office. P7794 B

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In good condition.
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All the above complete with Motors and Starters if desired. Inspection invited.
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For continuation of For Sale Advertisements see page 3

A Seven-Day Journal

French Labour.

THE steady advance of wages in France is a natural corollary of the higher living costs following upon the depreciating currency, involving, as it does, the payment of more money for raw material and foodstuffs purchased abroad, and the rarefying of similar French products which are bought by foreign countries with higher money values. The increased wages are also rendered inevitable by the comparative scarcity of labour. Several strikes have taken place during the week, and some of them have been settled by conceding the men's claims. The situation is regarded as so serious that efforts are being made to check a labour movement which must cause embarrassment in the early future. An appreciation of money values must take place at some time or another, and the wages paid would then be out of all proportion to the work done. An attempt is made to provide some remedy by encouraging the importation of labour; but it has so far had little effect upon the situation, and the wages' bill is becoming an increasingly awkward problem amongst firms which are unable to increase their selling prices. The only solution is to be found in the employment of labour-saving machinery and in the adoption of more economical manufacturing processes. The French industry is being compelled under stress of circumstances to dispense with labour as much as possible, and the progress being made in this direction must eventually exercise a great influence upon economical production in French engineering works.

Empire Wireless.

ON Monday last a deputation from the Empire Press Union, introduced by Viscount Burnham, the President of that Union, waited on the Postmaster-General, to urge the importance of securing adequate Empire wireless communication. In his reply, Sir Laming Worthington-Evans said that the present position was that the Post Office had asked for applications for licences from anyone in private enterprise, and two companies had come forward, namely, a cable company and the Marconi Company. The cable company was asking for a licence to communicate with India, and this matter was engaging the attention of the Post Office and the Indian Government. With regard to the Marconi Company it was hoped that the question of its licence would be finally settled in about two weeks time, and as soon as that was done there was nothing to prevent that company from proceeding with the erection of a high power British station. As far as the Post Office was concerned land had been secured near Rugby, and the masts were ordered. It was to be expected that this Government station would be ready in a little over a year's time. The Postmaster-General added that with regard to wireless rates he did not think it possible to fix a definite rate in advance of any agreement or licence, but as wireless communication developed, the rate would, if kept below the cable rates, have the effect of cheapening long-distance communication.

Engineers and Railwaymen.

IN a statement which was issued on Monday last the Executive of the Amalgamated Engineering Union repudiates the action of the National Union of Railwaymen in attempting to speak for the railway shopmen in the matter of wages and conditions. This statement is a reply to the proposal of the N.U.R., adopted at the annual conference at Crewe, hat the shopmen's wages and conditions should be dealt with by the conciliation machinery set up under the Railways Act of 1921. In it reference is made to the fact that at a conference held in March the N.U.R. decided that as far as shopmen's wages were concerned, there must be no further reductions, and that the Executive be instructed to call a national strike if any attempt were made by the companies to enforce the reductions. The statement expresses surprise that such a proposition should be seriously put forward as a means of dealing with the question, and affirms the absolute opposition of the A.E.U. and other craft unions, not covered in any shape or form by the Railways Act, 1921, to the question of the shopmen's wages and conditions being dealt with under an Act which solely concerns those railway employees engaged in the manipulation of traffic, and from which the railway shopmen were expressly excluded. There is no doubt that any negotiations that do not allow of the A.E.U. and other craft unions being consulted will certainly lead to trouble.

British and American Lifeboat Services.

DURING the week preliminary trials of the twin-screw 60ft. Barnett type motor lifeboat for New Brighton were carried out, and the actual sea trials are now in progress. Engined with two of the Lifeboat Institution's 90 H.P. motors, the new vessel is the most powerful motor lifeboat afloat, although she is 2in. shorter than the new Dutch lifeboat Brandaris. Among other visitors invited to witness the trials, were Captain de Booy, the secretary of the North and South Holland Lifeboat Society, and Rear-Admiral William Edward Reynolds, Commandant of the United States Coast Guard, and head of the United States Revenue Service, to which the life-saving service belongs. The American Lifeboat Service is provided and maintained by the Government and not by a voluntary society as in this country. The cost of maintaining the American service is about £1,250,000 per year, compared with the British cost of £250,000. It must be remembered, however, that the United States service provides special telephone facilities around the coast and also the rocket apparatus. Actually the numbers of lifeboats in the two services are about the same, being some 236 each. So far the large motor lifeboat, such as the 45ft. and 60ft. boats, has not been developed in America. The American Government, however, provides a number of very powerful steamers for revenue purposes, which are able to keep the sea in all weathers, and undertake a good deal of life-saving work.

Return of Vessels Lost.

ACCORDING to the returns published during the week by Lloyd's Register of Shipping, the total number of steam, motor and sailing vessels totally lost, condemned or broken up, &c., during the quarter ended December 31st last, was 131, the combined tonnage of which was 143,610. Great Britain and Ireland were the heaviest losers as regards both numbers of vessels and tonnage. They lost 23 vessels, of a total of 29,949 tons. Next in order of numbers came Japan, which lost 18 ships, the combined tonnage of which was 12,101. A much heavier loss of tonnage —27,813—was experienced by Italy, but it only represented 13 vessels. Three countries lost 10 ships each:—The United States, 20,059 tons; France, 9185 tons; and Germany, 10,041 tons. The same total—10—is given as being the loss experienced by "other European countries," the tonnage being 5835. The British Overseas Dominions lost 9 vessels, of 5278 tons; and Spain lost 9, of 12,645 tons. Norway and Sweden each lost 7, the tonnages being 5305 and 1657 respectively. Denmark's loss was only two boats, of a total of 283 tons, while Holland, Central and South America, and "other countries" each lost one, the respective tonnages being 2434, 317 and 708.

Electricity Profits.

TWO cases of profitable electricity undertakings have come to our notice during the past week. On Wednesday the Electric Light Committee presented to the Southwark Borough Council a report which showed that for the year ending on March 31st last, a net trading profit of £16,525 had been realised. On the proposal of the Finance Committee it is recommended that £10,000 be allocated to the reduction of rates. The number of units generated showed an increase of 147,925 over the preceding year, and the Committee recommends a reduction in the scale of charges, to become operative as from the September meter readings. The balance sheet of the Brighton Corporation electricity undertaking shows for the year ended in March last a surplus of £27,887. It is proposed that of this amount, £15,000 be set aside to reduce the local rates. During the year the current generated shows an increase of nearly 2,000,000 units. The rates for current have been gradually reduced, but a cautious policy with regard to tariffs is advocated by Mr. J. Christie, the chief engineer, who wishes to create a substantial reserve fund.

Sir James McKechnie.

IT is announced that Sir James McKechnie, K.B.E., has resigned his position as the managing director of the Barrow Naval Construction Works of Vickers Limited. We understand, however, that he will retain his seat on the board of directors of the Vickers Company. Commander C. W. Craven succeeds Sir James in charge of the Barrow works.

Commercial Treaties.

THE attitude of the industrial community in France towards the necessity of opening up markets abroad is accurately reflected in the resolutions that continue to be passed by the Chambers of Commerce and other bodies, protesting against the carrying out of a policy of home protection which is liable to provoke retaliatory measures from other countries. That policy was foreshadowed recently by the declaration of the Minister of Agriculture to the effect that higher import duties would be imposed on wines, the result being that Portugal refused to continue negotiations for a commercial treaty, and Spain announced its intention of declining to renew the existing arrangement. The protests prove that the industrial and commercial communities are determined that the interests of an agricultural class shall not be allowed to imperil the policy of reciprocal arrangements which the Government has been endeavouring to carry out with various countries since the Armistice. So strong is the agitation that the Prime Minister has promised to see that the existing arrangements are maintained, and it is hoped that others will be carried through, while the possibility of the present negotiations with respect to German reparations resulting in a wider commercial agreement between France and Britain would be viewed with considerable favour on the other side of the Channel. A settled policy for the development of European trade would constitute one of the strongest factors in industrial activity.

Safety in Railway Travel.

SOME interesting statistics are given in the annual return of accidents on British railways for the year 1922, which has just been published. Compared with other years, it appears that the record for 1922 is among the best during the present century. With regard to actual passengers, only five persons—one in every 300 million carried by the companies on some 20,000 miles of railways—were killed. Persons other than passengers killed during 1922 include 61 at level crossings, &c., while the deaths of trespassers and suicides amounted to 315. The death roll we have quoted stands out in striking contrast when compared to the number of fatal road and street accidents in Great Britain for the same year. According to published returns, these include deaths arising from the following causes:—Motor omnibuses, 196; tramcars, 111; other mechanically propelled vehicles, 2026; horse-drawn vehicles, 265; cycles, 170. This total of 2768 fatal accidents corresponds to over seven persons per day killed by road traffic in Great Britain. In London alone 684 persons were killed by street traffic in 1922.

Dunlop Rubber Tires.

MONDAY, the 23rd inst., was the thirty-fifth anniversary of the granting of the first Dunlop pneumatic tire patent, and the occasion was marked by a special visit to the Dunlop Rubber Company's works at Fort Dunlop, where the guests were welcomed by Sir Eric Geddes, the chairman of the company. In tracing the development in mechanical road transport, Sir Eric said that it had been estimated that the world possessed 15 million motor cars, of which 12 million were owned in the United States of America. He had been told authentically that the capital locked up in the American motor industry was equal to the total capital of the iron and steel industry, and that with the coming of road transport the United States had spent more on new roads in the last twenty-five years than the total capital invested in all kinds of railway property. Referring to the invention of the first pneumatic tire by the late Mr. J. B. Dunlop, he had been told by those who knew the inventor that the original idea grew out of a desire to save jolting on a child's machine fitted with solid rubber tires. First of all, rubber tubes filled with water were tried. They were bound to the wheels with surgical tape taken from his veterinary surgery. Later, the water was changed to air, and the pneumatic tire as we know it to-day took its shape.

A Railway Strike Threat.

THE fourteen days' notice which the National Union of Railwaymen have given to the London and North-Eastern Railway to apply Award No. 728 of the Industrial Court to the railway shopmen on the old Great Northern section of the company's system expires in the middle of next week, and unless further negotiations are instituted or the company agrees to apply the award, the threat to call out on strike all the shopmen on that section who belong to the N.U.R. will take effect on Thursday next. As the matter now stands, the chief general manager has written to the other craft unions pointing out that the question is one that concerns unions other than the N.U.R., and that the company has reason to believe that certain of these unions do not desire the extension of the award to the Great Northern shopmen. It is reported that the A.E.U. has accepted an invitation to meet Sir David Shackleton at the Ministry of Labour to-day to receive a report on his interview with the N.U.R.

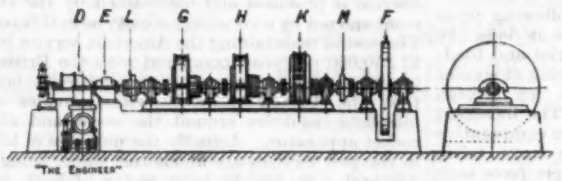
Smoke Abatement.

THE text has just been published of a Bill introduced by the Earl of Onslow, which is intended to amend the existing law relating to smoke nuisances. We may quote the following provisions: With regard to smoke nuisances the Bill increases the maximum penalty from £5 to £50, whilst in respect of an order relating to a smoke nuisance the maximum penalties of 10 and 20 shillings are increased to 40 shillings and £5 respectively. With regard to London, smoke other than black smoke is included in the Bill, and the expression "smoke" is held to include soot, ash, grit, and gritty particles. Power is provided whereby the Minister of Health may, after a public inquiry and after consulting local authorities and other interests concerned, extend the list of noxious or offensive gases which are given in the Alkali, &c., Works Regulation Act of 1906. As drafted the Bill does not apply to Scotland or to Northern Ireland.

Electricity in Mines.

No. I.

IN the past, colliery engineers have, it seems, underestimated the need for economy in the consumption of low-grade fuel. The report of the Coal Conservation Committee showed that in 1913 the total output of the mines in the United Kingdom was 287,430,473 tons, of which 18,168,811 tons, or 6.33 per cent., were consumed at the collieries themselves. Broadly speaking, the pits in Great Britain are scattered over the whole of the country. There are, it is true, concentrated areas in the divisions of Yorkshire, the North Midlands and South Wales, but in 1920 the collieries in those parts only represented about 40 per cent. of the total number of collieries. Only a small percentage of the collieries are situated in the areas served by a large public supply, and generation on the spot is in many cases essential. In 1921 the aggregate amount of power used in collieries was 3¼ million horse-power, of which 2,415,841 horse-power was produced by reciprocating engines. Apart from winding plant, the aggregate horse-power of electrical machinery was 1,027,857, the winding equipments representing 53,006 horse-power. Apparently, it has not been possible to find a corresponding figure for the aggregate horse-power used for steam winding, but writing in the *Metropolitan-Vickers Gazette* some time ago, Messrs. Perry and Stubbs assumed that it was equal to half the reciprocating engine output, or 1,207,920 horse-power. This is probably very much on the low side, but even on this basis the electrical winders only represent about 4.4 per cent. of the horse-power used for winding purposes. In the case of old pits, steam engines were, of course, put into service at the outset, and the field for electric winders has been limited to collieries near a large public supply, to those having a large privately owned power station, and where small equipments are supplied from waste heat stations at larger pits. It has been considered sound engineering practice to install steam winding engines and to generate electricity for other purposes from the exhaust steam available from the engines, and in the past this scheme has in many cases been justified, and has proved a more economical scheme than that of taking power from a supply company.



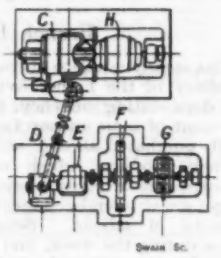


FIG. 3 AND 4—MODIFICATIONS OF "S.P." WINDING SYSTEM

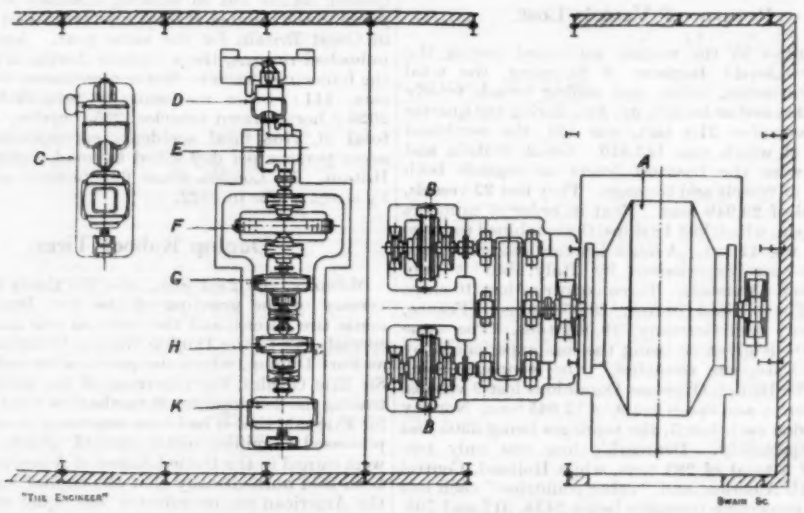


FIG. 1—ARRANGEMENT OF "S.P." WINDING EQUIPMENT

In order to increase the field for the electric winder, an interesting scheme has been put forward by the Metropolitan-Vickers Electrical Company, the object of the scheme being to bring the advantages of the electric winder within the reach of every colliery company, irrespective of its existing or prospective power arrangements. With this system, advantage may be taken of the direct application to colliery winding of the high-speed condensing turbine with its high efficiency, reliability and small size, whilst with the minimum amount of electrical plant delicate and smooth operation is obtained. The consequent reduction in boiler plant, cooling towers and the possibility of using modern high-pressure boilers has enabled many improvements to be secured, and also a reduction in the overall capital expenditure.

It is, of course, impossible to lay down hard and fast rules for the application of this system, as every case must be considered on its own merits in order to arrive at the relative economy of the system as compared with that of existing schemes. Its main advantage is low initial cost, and under certain circumstances low operating cost. The principal objects that have been aimed at in the development of the scheme are (1) complete separation and consequent independence of the winding equipment from the remainder of the colliery load, and (2) elimination of all fluctuations, either in the form of electrical fluctuations or peak steam demands. Fig. 1 shows an arrangement for a large colliery operating in a country district outside the range of any existing power supply. In this illustration A is the winding drum, B direct-current winding motors, C a high-pressure turbo-alternator equipment for a colliery auxiliary load, D a condensing turbine, E reduction gears, F a fly-wheel, G and H direct-current generators, and K an eddy current brake which provides a means of absorbing all regenerative energy above the amount required to return the fly-wheel to its normal speed. In other words, the only energy absorbed by the brake is the regenerative energy returned to the fly-wheel set during a trip in which material is being lowered into the pit, the brake being automatic in action, and being controlled by the turbine governor.

In effect, the equipment operates in the same way as a Ward Leonard equipment, taking its power from

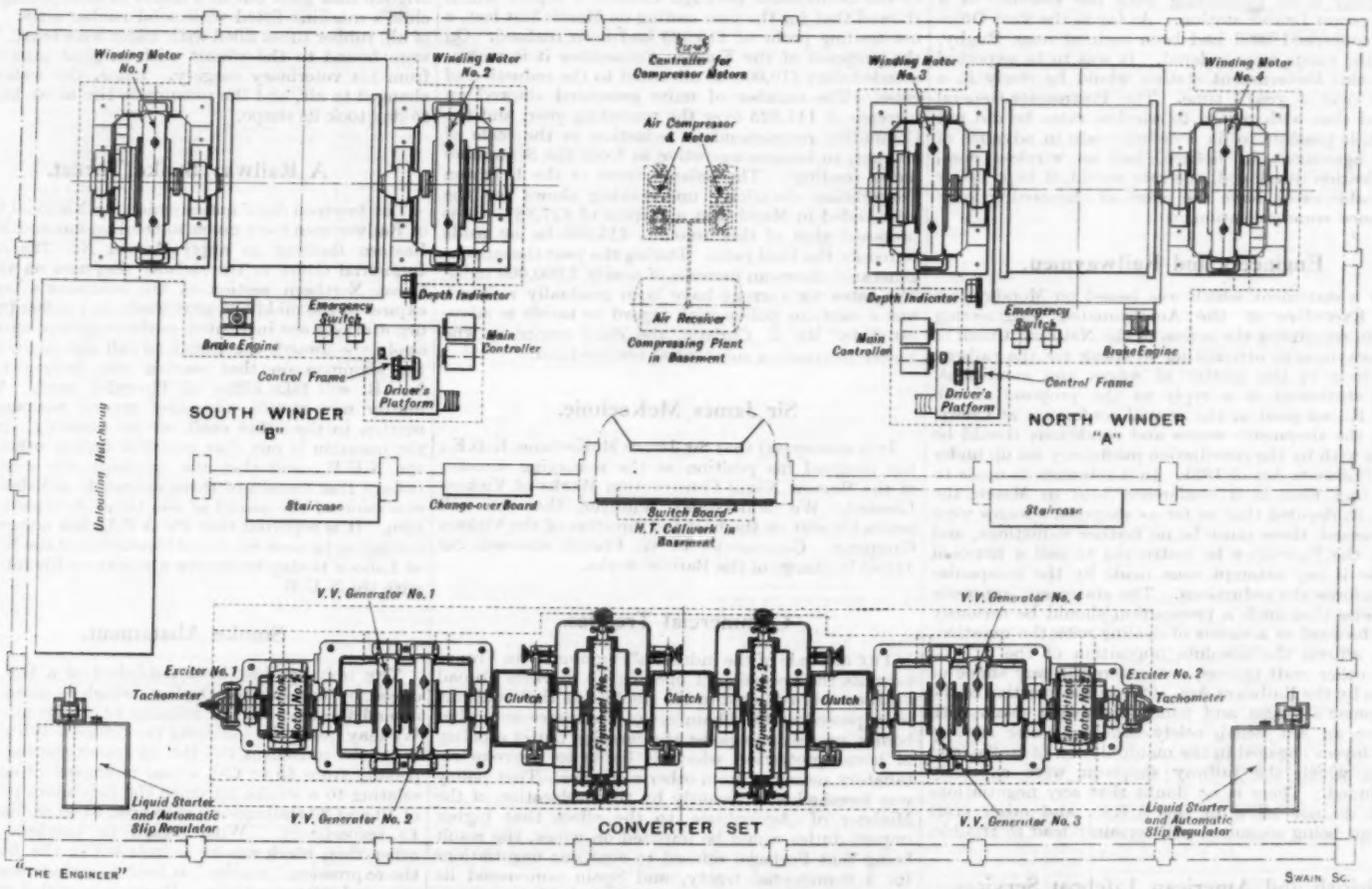


FIG. 2—ARRANGEMENT OF THE ELECTRIC WINDING ENGINES AT CRONTON COLLIERY

a large centralised supply. A modification of the system is shown in Fig. 3, in which the parts D, E, F, G and H correspond with those marked with the

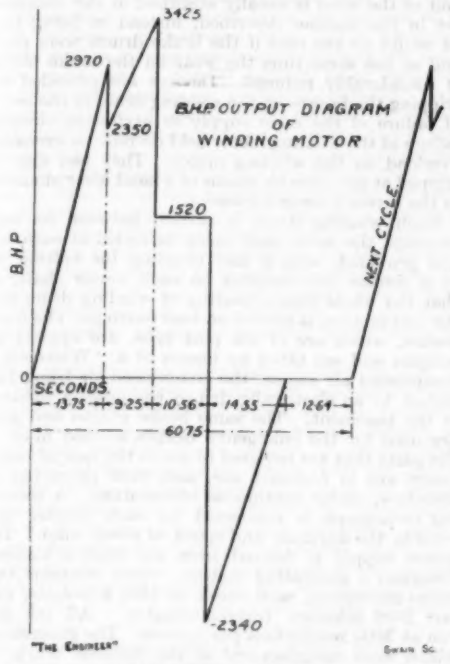


FIG. 5—POWER DIAGRAM

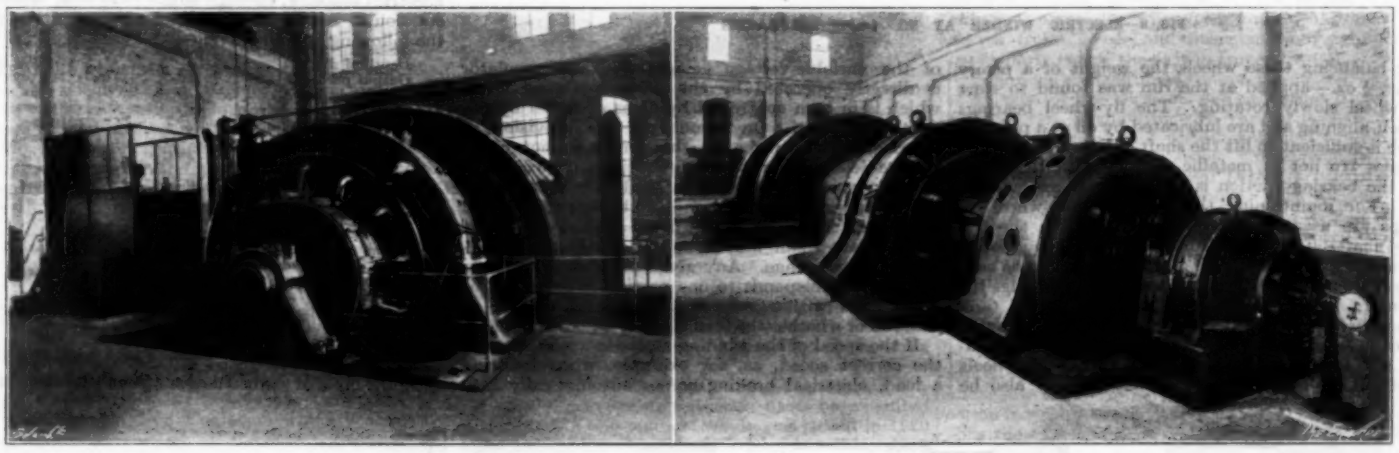
same letters in Fig. 1, but the eddy current brake is substituted by an induction motor K, and L and M are disengaging clutches. During normal winding, the turbine supplies the necessary power, and the induction motor is used as a brake when necessary by supplying direct current to its stator windings. During the period of non-winding, when occasional light load winds are only required, the turbine is declutched and the equipment runs as an ordinary Ward Leonard set, taking its energy from the induction motor, which then operates from the public supply. It is considered that this arrangement might have a large application and prove a very economical scheme for collieries operating in conjunction with a supply company. A scheme embodying the same broad principles, but in which a back-pressure turbine has replaced the condensing turbine used in the other two schemes, is shown in Fig. 4, in which G is an induction motor, which takes the place of the direct-current motors in Fig. 1, C the mixed-pressure turbo-alternator equipment for the auxiliary load, D a back-pressure turbine, E reduction gearing, and F the fly-wheel. H is a three-phase alternator.

It will be seen that the back pressure turbine exhausts into a mixed-pressure or make-up turbine to supply the auxiliary load about the pit. The winding motors and generators may be either direct-current or alternating-current machines, the only limitation being the size of the equipment. When the capacity is large, as in the case of the two schemes shown in Figs. 1 and 3, it is desirable to adopt direct-current motors operating on the Ward Leonard principle, but with a smaller plant it is possible to adopt three-phase motors and generators, as shown in Fig. 4. Normally, the back-pressure turbine would do the coal winding and would exhaust into the mixed-pressure turbine, which would supply the necessary power for the auxiliary load, the public supply acting as a stand-by. When operating in conjunction with a public supply, the following combinations are possible:—(1) Assuming the back-pressure turbo-alternator set is out of commission, the winder could then operate, either from the public supply or from the mixed pressure turbo-alternator; (2) if the mixed-pressure turbine was for some reason down for repairs, the back-pressure set could operate the winder and exhaust to atmosphere, and the auxiliary load could be dealt with by the public supply; (3) if both sets were out of commission the whole colliery could be run purely with electricity. The system is considered to offer distinct advantages from the point of view of the installation of the plant. In using steam engines for the winders and mixed-pressure turbines, the power-house site must be adjacent to the winding engine-house. With the system under consideration, however, this is no longer necessary, and the power-house may be placed in any position within reasonable distance of the pits should such a position be more convenient for water, building and coal handling. The cost of the necessary buildings, foundations, &c., has proved, on investigation, to be considerably less than that of the buildings and foundations required with the steam engine and mixed-pressure turbo-arrangement.

The English Electric Company has recently installed two electrically driven winding engines at the Cronton Colliery of the Hulton Colliery Company, and they are now being used in connection with the sinking of two pit shafts. The electrical equipment was manufactured at the Siemens works of the company, the high-speed fly-wheels by Scott and Hodgson, of Manchester, and the mechanical parts of the winders, such as drums, brake gear, &c., by Fraser and Chalmers, Limited. The general arrangement of the plant is shown in Fig. 2. The principle on which the installation is designed to work is a combination of the Ward Leonard system, with its ease of manipulation and certainty of speed control, with a fly-wheel equaliser interposed between the winding motors and the supply mains. The advantage of the equaliser in this instance is demonstrated by the fact that whereas the peak load on the winding motors when working on full duty is 3425 horse-power for each winder, the maximum demand on the generating plant is considerably less than half that value. Another advantage secured by the use of the fly-wheel system is that in the event of the main supply failing, sufficient stored energy is available to complete a wind. The winding drums, which are of the parallel type, are 16ft. in diameter and 13.5ft. wide, and when on full duty they will each be fitted with a balance rope of the same weight per fathom as the winding rope. When the work of sinking the pit shafts is completed, the winding engines will be required to work under the following conditions:—

Output of coal per hour	267 tons
Depth of shaft	730 yards
Net weight of coal per lift	4.5 tons
Number of lifts per hour	59.4 tons
Time of each complete cycle	60.75 seconds
Time for charging trucks	12.64 seconds
Net time for each lift	48.11 seconds
Weight of each cage with suspension gear	5.75 tons
Weight of each truck	5 cwt.
Number of trucks per cage	9
Weight of winding rope per fathom	38 lb.
Weight of balance rope per fathom	38 lb.
Diameter of winding drum	16ft.
Maximum drum speed	86 revs. per min.
Maximum speed of winding	72.16ft. per second

On the basis of the above conditions it is calculated that the brake horse-power output for the winding motors at the various stages of the winding cycle will have approximately the value shown in Fig. 5. For driving each winding drum there are two direct-current motors, each rated at 1550 brake horse-power and running at 86 revolutions per minute, and they are directly coupled to opposite ends of the drum shaft. One of the drums, with a motor in the foreground, is shown in Fig. 6. Each pair of winding motors is supplied with current from its own converter set, which consists of two variable-voltage generators for the main supply to the winding motors, a generator for the excitation circuits and an induction motor for driving the set. The two converter sets are mounted in line with two 27-ton fly-wheels between them, the fly-wheels being connected to each other and to each set by flexible clutch couplings, so that both units may be run as one set or either unit may be run independently with or without its fly-wheel each coupling being capable of transmitting 4000 horse-power. One of the converter sets is shown in Fig. 7, the fly-wheel and the second set being in the background. The induction motors are slip-ring machines and are supplied directly from the three-phase, 3300/3000-volt, 50-cycle colliery mains. Normally they run at a speed of 493 revolutions per minute, but slip-ring regulators in the rotor circuits enable resistance to be inserted in the rotor during the



FIGS. 6 AND 7—WINDING MOTOR AND CONVERTING SETS AT CRONTON COLLIERY

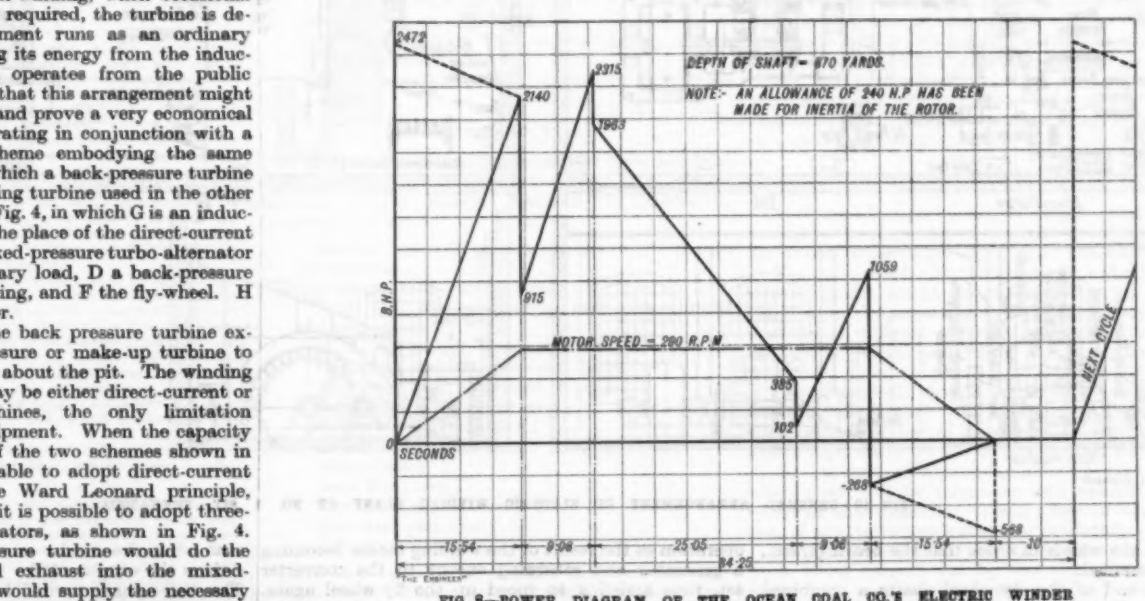


FIG. 8—POWER DIAGRAM OF THE OCEAN COAL CO.'S ELECTRIC WINDER

acceleration periods, and the fly-wheels are thus caused to give up some of their kinetic energy.

Each of the steel fly-wheels for the motor generator

sets has a diameter of 12ft. 3in., and weighs 27 tons, and each wheel is built up of two rings forming the rim. The rings are clamped on each side of a central disc, the parts being interlocked by turned tongues and grooves in such a way as to relieve the bolts which pass through the rings and disc from centrifugal stresses. The accurate balancing of such large fly-wheels is naturally a matter of great importance. The method adopted was to support the wheel on its shaft and to float it on oil forced under the journals. The extent to which friction is eliminated by this method can be judged from the fact that

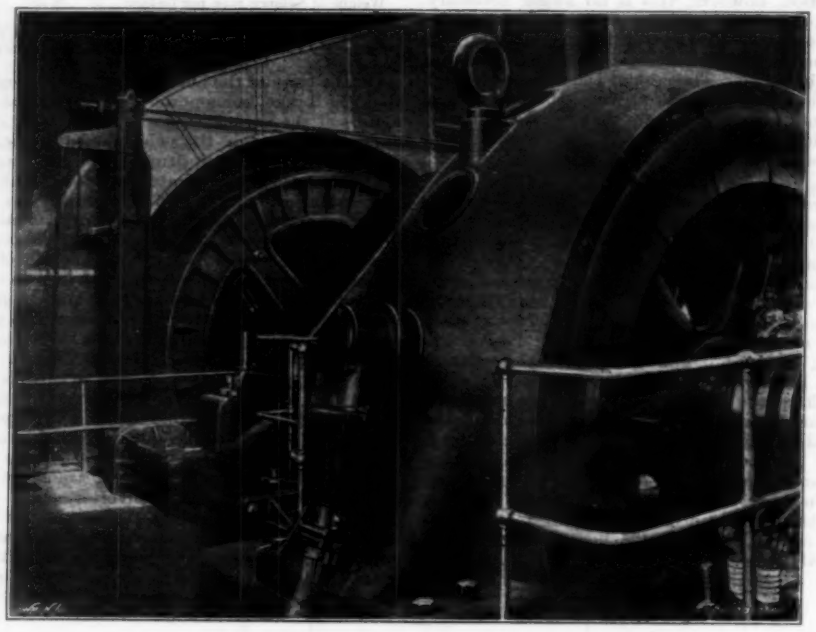


FIG. 9—ELECTRIC WINDER AT NO. 1 PIT, TREHARRIS

after balancing these wheels the weight of a penny —viz., ¼ oz.—applied at the rim was found to start the wheel slowly rotating. The fly-wheel bearings are self-aligning and are lubricated by oil at a pressure which is sufficient to lift the shaft, so that the bearing surfaces are not in metallic contact with the shaft, and the bearing friction is consequently exceedingly low. For maintaining the pressure gear-wheel oil pumps are used, and they are driven from the fly-wheel shaft. There are also separate auxiliary motor-driven pumps for use when starting up or in the case of emergency. After passing through the bearings the oil enters an oil cooler, which is situated in a tank formed in the fly-wheel bed-plate, and it then again passes to the tanks so that a closed system of lubrication is formed. Powerful brakes under the wheels serve for stopping purposes, and they may also be used to lift the wheels in order that the bearings, &c., may be examined.

At each end of the fly-wheel shafts a combined flexible coupling and clutch is fitted so that disconnection may be made whilst the set is running. The alternating current supply, and the various direct-current excitation circuits, are controlled from a switchboard. There is also a change-over board which is designed to give complete elasticity in the supply of any winding motor or pair of motors from any variable-voltage generator or pair of generators. The advantage of this arrangement is that if one converter is for any reason stopped, it would still be possible to keep both winders running. It is also possible to run both winders on light load from one converter set without the fly-wheels when actual coal-winding is not required, as, for instance, during the night or week-ends. The speed and direction of rotation of the winding motor are controlled in the usual way by regulating and reversing the field current of the variable-voltage generators. The regulator is directly operated by the driver's control lever, which is in turn controlled by cams operated by the depth indicator. On account of the provision of interlocking arrangements the driver cannot cause the pre-determined rate of acceleration to be exceeded, and the speed of winding is gradually reduced towards the end of the wind and the brakes are applied. The depth indicator is also fitted with a device for tripping the main brakes in the event of an overwind of either cage. Any given position of the control lever corresponds to one particular speed. This holds good within very fine limits, irrespective of the load or whether the load is being raised or lowered.

If the speed of the winding motor increases beyond the correct speed, as, for example, when lowering a load, electrical braking comes automatically into operation as the result of the winding motor becoming a generator and returning energy to the converter set, thus assisting to speed up the fly-wheel again. For this reason an over-speed apparatus is not provided on the winding engine itself, but the converter set is furnished with a device which trips the main brakes in the event of the converter's speed becoming excessive. This device, which consists of a speed indicator fitted with maximum and minimum contacts is to be seen at the end of the converter set—Fig. 7. The energy given up by the rotating parts of the winder during the retardation period at the end of the wind is usually absorbed in the converter set in the manner described, instead of being lost, as would be the case if the brake drums were used, and at the same time the wear on the brake blocks is considerably reduced. Devices are provided for tripping the brakes on the winding drum in the event of failure of the main supply or excitation circuits, failure of the winding motor field current, or excessive overload on the winding motor. They can also be tripped at any time by means of a hand lever mounted in the driver's control frame.

Each winding drum is carried between its own bearings, the drum shaft being extended at each end and provided with a half coupling for bolting up to a similar half-coupling on each motor shaft, so that the whole line, consisting of winding drum and the two motors, is carried on four bearings. The main brakes, which are of the post type, are applied by weights and are lifted by means of a "Whitmore" compressed air engine, the compressed air being furnished by an electrically driven compressor situated in the basement. The same brake engine and gear are used for the emergency brakes, so that most of the parts that are required to act in the case of emergency are in frequent use, and their operation is, therefore, under continuous observation. A recording tachograph is connected to each winder and records the duration and speed of every wind. The power supply is derived from the Hulton Colliery Company's generating station, which contains two turbo-generators, each rated at 1500 kilowatts, and one 2000 kilowatt turbo-alternator. All the sets run at 3000 revolutions per minute. The generators, which were manufactured at the Siemens Works of the English Electric Company, are driven by Richardsons-Westgarth turbines.

An electric winding engine working on the alternating current system has also recently been installed at the Ocean Coal Company's No. 1 Pit, Treharris. The plant consists of a cylindro-conical drum driven by a three-phase induction motor, made by the English Electric Company, through single reduction machine-cut double helical gearing designed to conform with the following specification :—

Depth of shaft	870 yards
Output per hour	214 tons
Net weight per lift	5 tons
Time of complete cycle	84½ sec.
Interval for banking	10 sec.
Net time for each lift	74½ sec.
Diameter of winding rope	1.9in.
Weight of rope, per foot	7 lb.
Weight of each cage and bridles	7 tons
Weight of each tram	10 cwt.
Number of trams per cage	Four
Maximum drum diameter	20ft.
Minimum drum diameter	12ft.
Width on maximum diameter	6ft.
Maximum drum speed, revolutions per minute	46.3
Maximum rope speed, feet per second	48.5
Maximum full load motor speed, revolutions per minute	288
Supply	3-phase, 3300 volts, 50 cycles

On the basis of the usual assumptions, it is estimated that when the winder is working to the above conditions the output of the motor will be as in Fig. 8. The three-phase reversible induction motor, which is shown in Fig. 9, has a slip-ring rotor mounted in two pedestal bearings, and the shaft is extended for coupling to the pinion shaft by a flexible coupling. The motor, which has been designed to withstand counter-current braking, and is specially strengthened

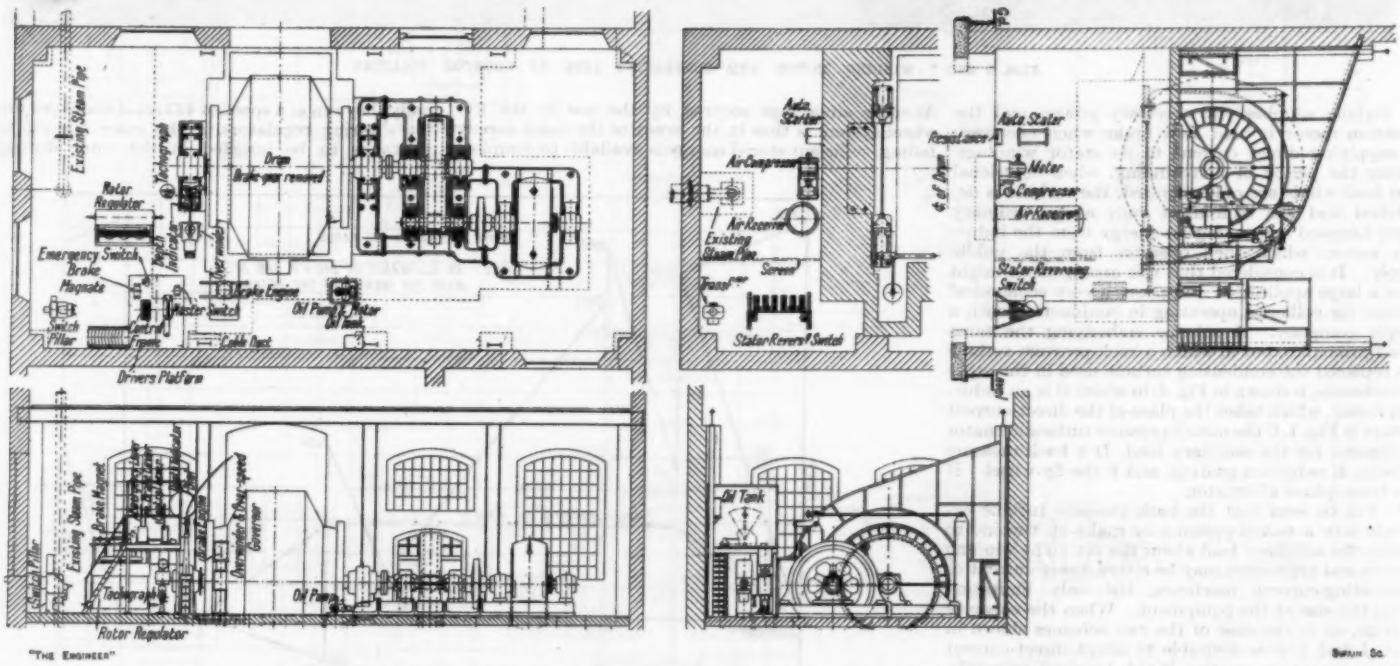


FIG. 10—GENERAL ARRANGEMENT OF ELECTRIC WINDING PLANT AT NO. 1 PIT, TREHARRIS

to enable it to withstand the arduous duties of a winding engine, is rated for a normal continuous output of 1475 brake horse-power. The general lay-out of the plant is shown in Fig. 10. The controller, which was supplied by Allen West and Co., of Brighton, is of the liquid type. It consists of a rotor regulator, high-tension type stator reversing switch, with a master switch for energising the contactor coils, and a special control lever with an auxiliary compressed air operating cylinder. An accelerating control device, which permits the maximum rate of acceleration to be fixed, irrespective of the driver's control, is also fitted. The main switchgear which is of the English Electric Company's draw-out type, is fitted with two triple-pole isolating devices, an oil switch with one no-volt and three overload releases, two trifurcating boxes and the necessary current and potential transformers. On the outside of this pillar there is a cast iron box which contains three high-tension fuses for the primary side of the auxiliary transformer. An ammeter, a voltmeter, and air-pressure gauge are mounted in the driver's cabin.

The auxiliary and emergency devices include a 10 brake horse-power electrically gear-driven air compressor with automatic starter and air pressure switch to supply compressed air for the brakes, a three-phase solenoid brake magnet to operate the trip gear of the emergency brake, two end limit switches in the pit-head structure to trip the brake magnet in the event of an overwind by either cage, and a Whitmore overwind and overspeed gear, which, besides providing an additional protection against overwind, trips the emergency brake in the event of the speed exceeding the maximum at any part of the wind or on the driver failing to retard at the proper instant as the cage approaches the bank. There is also an auxiliary air cylinder and piston to which a weighted lever is attached, and in the event of the air pressure falling below a pre-determined limit, this lever falls and operates the emergency trip gear. Further, in the event of the current failing, or in the event of overload on the motor, the main switch is tripped, thus releasing the plunger of the brake magnet which in turn operates the emergency trip gear. Interlocking gear is also provided to prevent the emergency gear being re-set unless the main control lever is in the off position and the brake control lever in the full on position. A recording tachograph of the horn type, as manufactured by Glenfield and Kennedy, has also been supplied. Fraser and Chalmers were the sub-contractors for the mechanical parts of the single-reduction double helical gearing, the gearing itself being made by Citroëns. The plant was constructed to the specifications of Sparks and Partners, of Blackfriars House, New Bridge-street, E.C. 4.

Deterioration of Structures Exposed to Sea Action.

THE following letter has been addressed to various dock and harbour authorities by the Committee of the Institution of Civil Engineers which is investigating the deterioration of structures exposed to sea action:—

In 1916, under the auspices of the Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research, a special Committee was nominated by this Institution to carry out an investigation into the deterioration of structures of timber, metal and concrete when exposed to the action of sea water.

Application was made to the Advisory Council for a grant in aid of this research, and it was estimated that the bulk of the work would be completed in five years, involving an estimated expenditure of £8000, though it was pointed out that it might be desirable to continue certain observations for a further period of five or even ten years, and that it might in consequence be necessary to ask for a supplementary grant. The grant was acceded to, and on March 31st of this year the total sum advanced amounted to £8490, or slightly in excess of the sum originally mentioned.

Hitherto the grant by the Advisory Council has been the sole source of income for carrying on the research, with the exception of services given free by certain harbour authorities, engineers and others. This Institution has provided, free of all cost, a room which is used solely as a museum for the exhibition of specimens and photographs and for the clerical staff of the Committee; but the state of the Institution funds does not allow of it making any definite money grant towards the cost of the research.

The Advisory Council have now intimated to the Council of this Institution its willingness to provide further grants beyond the £8000 above referred to, but on the condition that one-half of the expenditure controlled by the Research Committee should in future be met from sources other than the grants from the Department. It may be said that these are the only conditions upon which the Department now makes grants for research work, and it is on account of these conditions that this Institution now finds it necessary to appeal for assistance to those outside bodies and authorities who would be benefited by the research.

Attached hereto is a memorandum detailing the work now being carried out by the Committee, which, stated briefly, is as follows:—

In the first instance, reports were obtained from numerous ports giving their experiences of the materials under consideration, accompanied by specimens, photographs and drawings, which have been placed in the museum. The specimens of timber, iron and steel, &c., form a unique collection, showing the deterioration of such materials due to marine organisms and other causes after exposure for different periods at many ports. They have all been carefully labelled and catalogued and placed in the museum at the Institution, where they are available for inspection by anyone interested in the work. Special reports on cognate subjects were also obtained. These were all collected, edited and published in one volume in 1920, forming the first report of the Committee.

This has led to the second or experimental stage upon which the Committee is now engaged, which is being carried out in three main directions:—

(*a*) In regard to the corrosion of metals, for which purpose various samples of metals have been prepared and exposed to sea action at Plymouth, Colombo, Auckland, N.Z., and Halifax, N.S.

(*b*) In regard to the destruction of timbers by marine borers, for which purpose specimens of timber impregnated with different poisons have been exposed at Lowestoft and Colombo.

(*c*) In regard to paint preservatives, for which purpose a number of steel plates have been coated with various paints for exposure at Southampton.

The importance of this work to all authorities responsible for docks, piers, and other sea structures must be apparent, and it is hoped that the ultimate result of the research will be the effecting of useful and substantial economies in the cost of such works, more particularly in regard to maintenance charges.

It is clear, however, that the experiments are now at that intermediate stage from which no definite conclusions can as yet be drawn, and that if any useful and practical results are to be obtained—whether of a positive or negative character—they must be continued, and the indications derived from them pursued to their logical end. Research of this nature must necessarily be slow, but it is satisfactory to note that the results so far obtained, particularly in connection with the timber experiments, are distinctly encouraging.

It is felt that to allow the work at the present stage to lapse for want of funds before any definite results have been obtained therefrom would be most deplorable, and it is for this reason and in these circumstances that the Council of the Institution of Civil Engineers, with every feeling of confidence, has directed that appeal should be made to you for assistance.

It is considered that in the first instance approximately £1250 will be required annually for the next five years. To meet the requirements of the Department of Scientific and Industrial Research, it is therefore necessary to raise by subscription about £600 or £700 a year.

The question, of course, appeals to all owners of sea structures, great or small, but any attempt to apply to all for assistance would probably defeat its own object. This appeal is therefore being addressed to the principal dock and harbour authorities in the United Kingdom, the Colonies and India, and the principal dock-owning railway companies.

If, as it is hoped, your Board will, in the circumstances detailed above, be willing to assist in the manner sought for, this Council would greatly appreciate the naming by you of some maximum annual contribution your Board would be willing to guarantee for the next five years, including the current year. The sum actually asked for would depend upon the estimated requirements for the year and the amounts of the promised contributions. Copies of the published reports and statements of accounts will, of course, be furnished to all contributors.

MEMORANDUM.

As a preliminary measure, a number of port and dock authorities throughout the United Kingdom, the Dominions, the Colonies and India, were circularised with regard to their experience of the behaviour of timber, concrete and iron and steel in sea water, and more than forty valuable reports were obtained, together with illustrative drawings, photographs and specimens. The photographs and specimens, which form an exceedingly interesting collection, have been arranged in suitable cases in a room set apart by this Institution as a Museum, where they are available for inspection by all interested in the work, the objects being carefully labelled and catalogued. Numerous samples of various timbers used in sea work have also been received from different places for experimental purposes.

The reports, together with several special reports and papers on cognate subjects, have been edited and printed in one volume, which was issued in 1920 as the first report of the Committee of this Institution on the deterioration of structures in sea water. Interim reports are also issued yearly detailing the progress of the work.

Following upon the above, a series of experiments in three main directions have been put in hand, and are now being carried out:—

(*a*) In regard to the corrosion of unprotected metals.

(*b*) In regard to the destruction of timber by marine borers.

(*c*) In regard to paint preservatives for ferrous metals.

(*a*) STEEL AND IRON.

In connection with (*a*), a number of specimen bars of the following metals have been prepared, under the direction of Sir Robert Hadfield, by Hadfields, Limited, Sheffield:—

Medium carbon steel with low sulphur and phosphorus;
0.40 per cent. carbon steel;
Mild steel, low manganese, and high sulphur and phosphorus;
Mild steel with 0.7 per cent. manganese;
Mild steel with 0.5 per cent. copper;
Mild steel with 2 per cent. copper;
Galahad non-corrosive steel;
3½ per cent. nickel steel;
36 per cent. nickel steel;
Armco iron;
Loor Moor iron;
Swedish charcoal iron;
Hot blast cast iron;
Cold blast cast iron.

These bars have been arranged in sets, each complete in itself. Three series of tests have been provided for, viz., for five years, ten years and fifteen years' exposure.

Each series consists of three sets of bars, one set to be fully immersed below low-water level, one set to be placed at about half-tide level so as to be alternately wet and dry, the third set being placed entirely above high-water level.

Sufficient specimens for three complete series of three sets each for five, ten and fifteen years' exposure have been sent to Plymouth, Colombo, Auckland, N.Z., and Halifax, N.S. An additional set has been forwarded to Plymouth for immersion in fresh water for a period of five years only. These were all despatched during the year 1921, and have therefore now been exposed for more than a year. These bars are superficially examined at intervals of about six months, and short reports upon their general conditions are forwarded to the Committee by the engineer-in-charge.

When the first five years of exposure have been completed, the three sets forming that series will be taken up at each port, and returned to the Committee for thorough examination, measurement of corrosion, analysis, and any tests which may be considered necessary.

Bars from each of the steels and iron have also been analysed and tested with regard to their physical properties at Messrs. Hadfields' laboratories, and some special corrosion tests on strained material have been carried out by Dr. J. Newton Friend, F.I.C., of the Municipal Technical School, Birmingham.

(*b*) TIMBER.

A large number of sample pieces of different timbers in use in the Colonies for works in sea water have been received. These, together with samples of certain European timbers for the sake of comparison, have been handed over to Professor S. M. Dixon, of the City and Guilds Engineering College, South Kensington, for testing purposes. No systematic and comparative tests of such timbers have hitherto been made, and the results should be of great value. These tests are now well advanced.

The question of preserving timber from destruction by marine borers has also been the subject of careful investigation, and in this matter the Committee have received the advice and assistance of Dr. G. Barger, F.R.S., of the University of Edinburgh. The more usual method of preserving timber is by injecting creosote. This, however, is by no means wholly effective, especially when the timber is subject to attack from *Teredo* and other marine organisms; particularly is this the case in tropical waters.

Preliminary experiments were conducted by the permission of the Director, at the Marine Biological Laboratories, Plymouth, with various poisons, from which it appeared that certain arsenical compounds were effective in this respect. Arrangements were therefore made with Professor Dixon for the impregnation of a number of wood blocks with varying proportions of these compounds. For the sake of comparison a certain number of plain untreated blocks, and blocks impregnated with ordinary creosote, were also prepared.

These blocks are exposed to the action of sea water at Lowestoft, where the *Teredo* has been found to be active. From time to time blocks are taken up and sent to Dr. Barger for examination and report. The results of these experiments have been encouraging, and show that arsenic has a distinctly preservative action in regard to marine borers.

In the case of the above test blocks, the arsenical compounds have been dissolved in alcohol. This method, however, would not be suitable for practical purposes. It was found, however, that the material could be satisfactorily dissolved in creosote. A number of test blocks have therefore been prepared by impregnating them with different proportions of the arsenical compounds dissolved in creosote, a number of blocks being also impregnated with creosote only, for the sake of comparison. These blocks have been sent out for exposure to sea action at Colombo, where the *Teredo* has been found to be particularly active, and it is hoped in the course of a year or two the results will show to what extent the addition of arsenic to the creosote has a useful effect in increasing the latter's resisting quality.

(*c*) PAINTS.

A series of experiments is being undertaken in regard to the preservative qualities of different paints. These are being carried out under the advice of Dr. J. Newton Friend. For this purpose a small number of steel plates, about 2ft. in length by 6in. wide, all made from the same ingot, have been prepared and coated with different compositions of paint, a standard red oxide paint being used for comparison and reference.

The plates will shortly be despatched to Southampton, where they will be fixed in three groups, viz., below low water, at about half-tide level, and above high-water level. It is proposed to leave the plates exposed as above for about twelve months, when they will be taken up and examined. The result of this examination will show in what direction, if any, the experiments can be usefully extended.

It will be seen from the above that the research work being carried out by the Committee is of a fairly wide and extensive character. Work of this nature must of necessity be slow, and at its present stage the results are, of course, undetermined, though those so far obtained, particularly in regard to the timber experiments, are distinctly encouraging.

(For description see opposite page.)

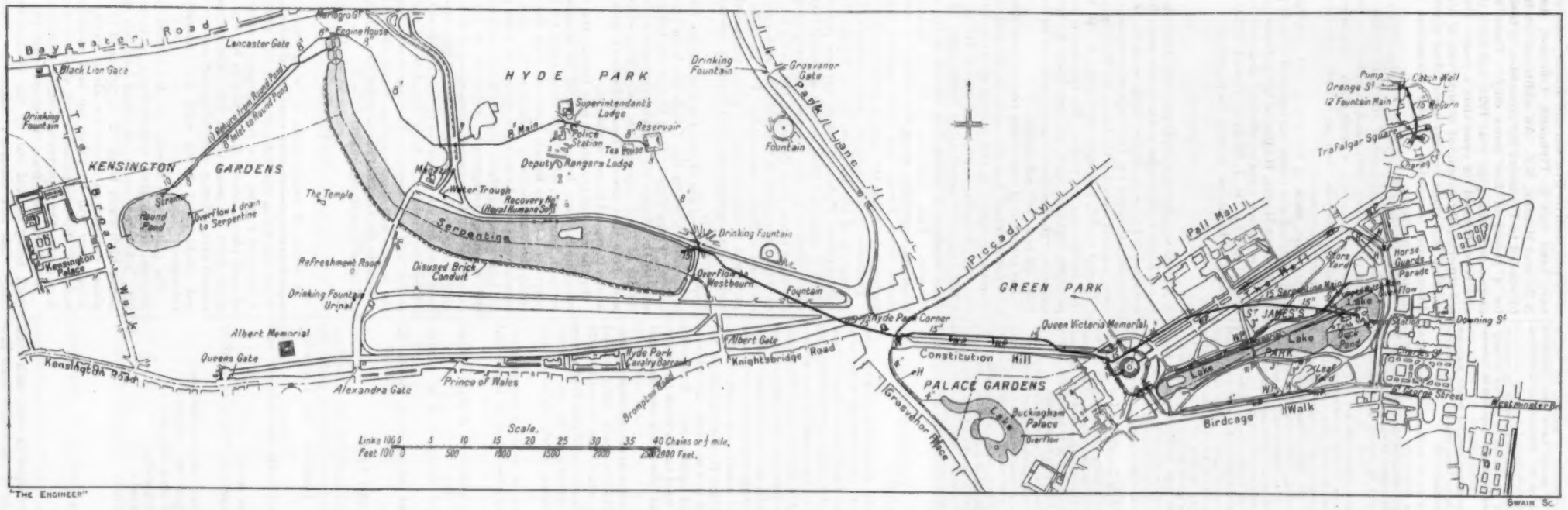


FIG. 6—PLAN SHOWING ROUTES AND SIZES OF WATER MAIN

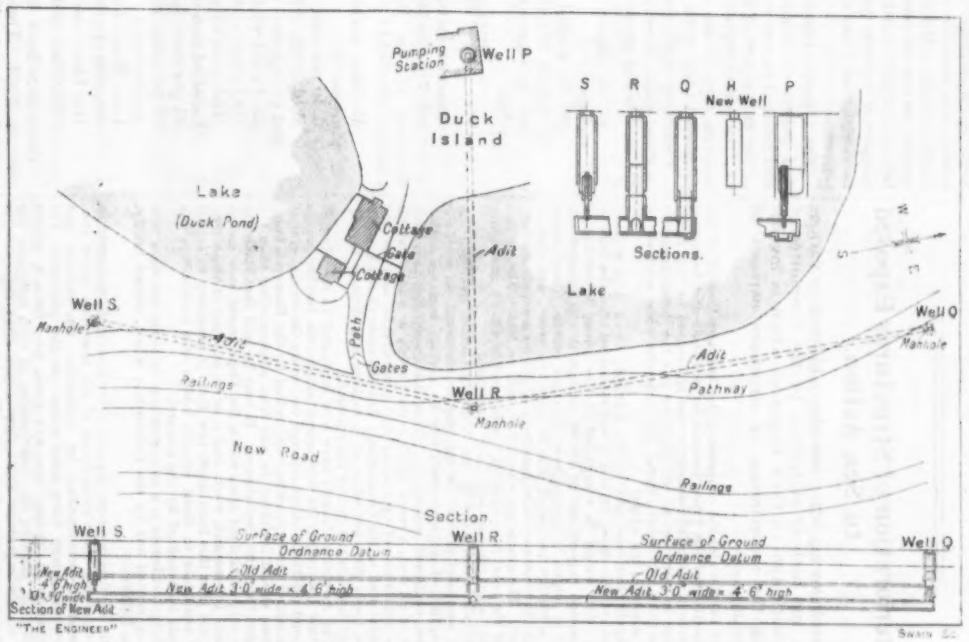


FIG. 7—PLAN SHOWING POSITIONS AND SHAPES OF WELLS AND DIRECTIONS OF ADITS

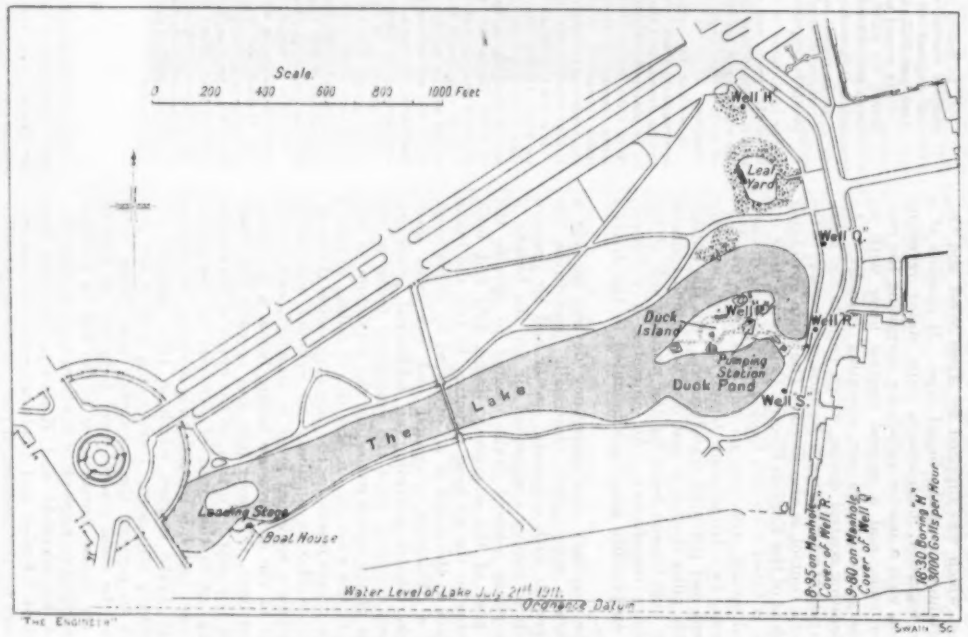


FIG. 8—PLAN SHOWING POSITIONS OF WELLS AND PUMPING STATION

It has been estimated that the annual world loss through the corrosion of steel and iron amounts to 20 millions of tons, and that the average life of timber in sea water in temperate climates does not exceed from fifteen to twenty years, whilst in tropical waters it falls as low as two years, or even less. If, as the outcome of this research, it should be possible to indicate the means by which the life of steel, iron or timber in sea structures could be prolonged by even a small percentage, it is obvious that the value of this research to those interested in such structures would, from a monetary point of view, be very great.

The St. James's Park and Other London Lakes.

No. II.*

As was said in the first article, the water for the lake in St. James's Park was originally obtained from the Tyburn and subsidiary streams. Later when those sources became polluted and their flows had to be diverted into sewers resort was had to a supply from the Serpentine River which, as has been showed, was fed by the Westbourne and from springs. Later still, even that supply fell short or became polluted, and another source had to be sought to obtain water not only for the St. James's Park lake but for the Serpentine, &c., in addition. Exactly who discovered that there was, at but small depth below the surface of the ground in St. James's Park itself, a not inconsiderable flow of water of very fairly good quantity we do not know, but it is a fact that subsequently to the repair of the lake in 1855–56 the supply of water for (*a*) the Serpentine, and the fountains at its head; (*b*) the Round Pond; (*c*) the lake in Buckingham Palace Grounds; and (*d*) the lake in St. James's Park was obtained by pumping from that source. At the present time the water, as will be explained later, is also available for supplying the fountains of the memorial to Queen Victoria in front of Buckingham Palace, and various standpipes along the routes of the mains in the vicinity which are employed for the purpose of road watering, &c.

Pumping Arrangements.

There are, at the eastern end of St. James's Park, and between the end of the lake and Horse Guards Parade, four wells—see Figs. 7 and 8—three of which, namely, those marked Q, R and S, are each about 35ft. deep. At the present moment, well H, which is newer and shallower than the others, being only some 24ft. deep, is not in use. All the wells are of about the same diameter, and all are quite close to one another, only some 90 yards or so separating the two furthest apart. Together they are capable of yielding 800 gallons per minute. Adits driven some 40ft. below standing water level join the bottoms of the three wells Q, R and S, and they, together with a further adit at the same depth, allow the water which rises in the wells to flow to a sump P formed on Duck Island. The adits are all 3ft. wide and 4ft. 6in. high, and they are driven on the level without gradient. There are, we believe, evidences of the existence of an older and smaller adit at a higher level, but it is no longer in use. From sump P the water is lifted by two centrifugal pumps, each capable of dealing with 300 gallons of water per minute, and delivered into a reinforced concrete reservoir formed below ground level on Duck Island. Originally, the pumps, which were of the horizontal duplex type, were steam driven, but now electrically driven pumps are employed, the pumps having been made by the Rees Roturbo Company, and the motors by Mather and Platt. Direct current at 400-410 volts is obtained from the mains of the Westminster Supply Company. There are arrangements by which one of the pumps may be started and stopped automatically, but we believe that, ordinarily, they are operated by an attendant. The original steam engine was of the beam type, and it acted in conjunction with the horizontal duplex pump mentioned above. Steam was obtained from two Cornish boilers. Both engines and boilers were removed when electricity was adopted as a motive power. The reservoir is capable of containing 210,000 gallons, and from it the water is lifted by two 6in. Rees-Roturbo electrically driven pumps and delivered into a 15in. cast iron main which runs under water across one arm of the lake—see Fig. 6—through St. James' Park, up Constitution Hill, across Hyde Park Corner and Hyde Park to the south-east corner of the Serpentine. From this 15in. main are taken off various branches. First of all there is a 15in. branch on the north side of Duck Island, through which the lake itself is fed. Another branch goes to feed the lake in Buckingham Palace grounds; still another supplies the fountains of the Memorial, while numerous others are taken off to supply mains laid along Birdcage-walk, the Mall, Constitution Hill, and various other paths in St. James's and the Green Parks and the Horse Guards Parade. The last-named mains supply water to a number of stand-pipes and hydrants for street-watering, &c. There is also a 10in. branch which can be used to feed St. James's Park lake at the west end. From near the discharge of the 15in. main into the Serpentine an 8in. main is taken across the Park to a reservoir which is situated near the tea pavilion and which is capable of holding half a million gallons of water. This reservoir was originally formed in connection with the Orange-street waterworks, which supplied the fountains in Trafalgar-square, the basins of which contain, together, some 100,000 gallons. In passing it may be mentioned that the reservoir is no longer employed for that purpose, the make-up water for the fountains being obtained from the mains of the Metropolitan Water Board. When the fountains are playing, the overflow finds its way into a sump in the Orange-street pumping station, whence it is re-circulated through the fountains by means of an electrically driven centrifugal pump. The arrangement of the piping is shown at the right top corner of Fig. 6.

The reservoir in Hyde Park is at a sufficiently high elevation to supply water by gravity to the fountains at the head of the Serpentine and also to the Round Pond in Kensington Gardens, with which it is connected by 8in. mains. The services to both fountains and Round Pond can be accelerated by two electrically driven centrifugal pumps arranged in the pump-house at Serpentine Head. This pumping station, like that on Duck Island in St. James's Park lake, was originally steam-operated. The overflow from the fountains finds its way down a miniature cascade into the Serpentine, but the latter can also be supplied direct from the reservoir without the water having to pass through the fountains. The Round Pond stands at such an elevation that water can be returned from it through the Serpentine fountains, though we believe that such a course is not ordinarily pursued. There is also a pipe by means of which the water in the pond can be drained into the Serpentine, as was actually done recently when it was determined to empty the pond so that it might be cleaned out and repaired. Quite lately, too, so we understand, a by-pass has been made from the pumps at Serpentine Head so that it is possible to draw water from the Serpentine and deliver it into either the reservoir near the tea pavilion or into the Round Pond, by which means, of course, the various other services can be supplied backwards as it were. We may here say that the Serpentine and Long Water cover an area of approximately 41 acres, and have a capacity of some 76,000,000 gallons. The area of the Round Pond is about 7 acres, and its capacity about 8,500,000 gallons. It is, moreover, possible, though it is not considered desirable, to run Serpentine water by gravity into the fountains of the Victoria Memorial. It is of interest to note, as confirming the assumption that the water of the Tyburn became polluted at a very early period, that the monks of Westminster Abbey did not use it for drinking purposes, though its flow is said to have operated their mills, but brought their drinking water from a point on the Westbourne, or Serpentine River, near where the dam forming the Serpentine Lake was subsequently built.

Returning now to the Victoria Memorial, it may be explained that the overflow from its basin is returned to the 210,000 gallons reservoir on Duck Island through two 10in. mains laid in the bed of the lake. There is an arrangement by which the water so returned is screened to free it from dirt, soot, &c., so as to fit it for pumping again into the 15in. mains.

The overflow, if there be any, from the lake in Buckingham Palace Grounds is led into a sewer at the south end of the lake, while the overflow from the St. James's Park Lake discharges through a valve-controlled outlet into the sewer mentioned in the first article as passing under the Horse Guards Arch. It may be explained that circulation through the lake is effected by means of a cascade at the west end, which is led to the overflow near the Horse Guards Parade.

The whole system may sound, as described, rather complicated, but in reality it is not, and seeing that a supply of sufficiently pure water is available at shallow depth in St. James's Park and, so far as is known, nowhere else in the neighbourhood of any of the lakes or the pond, it would appear that no other course than to use it is possible if the various sheets of water enumerated are to be kept supplied and in sanitary condition. It may be mentioned that the difference in level between the top water level in the sump on Duck Island when pumping is going on and the top water level in the reservoir in Hyde Park—that is to say, the extreme height through which pumping takes place—is 98ft., while the maximum amount of water pumped at any time is at the rate of 800 gallons per minute. Actually the maximum horse-power absorbed by the motors in ordinary working is some 40.

There is one further point which is worth considering. It is that it is extremely doubtful whether the combined flow of the Tyburn, the Westbourne and their subsidiary streams would be adequate nowadays to meet all requirements, even if the water were of a sufficiently high degree of purity, which it is not. Very nearly the whole of the catchment areas of these streams has now been built over or roaded, so that the off-flow is diverted into sewers, and comparatively little water ordinarily finds its way down the original courses of the streams, which are themselves now nothing more than brick sewers. That this is so in the case of Westbourne, at any rate, may be seen by anyone who takes the trouble to visit the rear of the pumping station at Serpentine Head. There are three arches, through one of which only a trickle of water may occasionally be observed.

The supply of water to the various lakes, &c., is, it may be explained, attended to by the Engineers Department of the Office of Works. We have to acknowledge our indebtedness to the heads of both the Maintenance and Engineering Departments of the Office for facilities for visiting the various works, as well as for particulars regarding them and for the originals from which our engravings have been prepared. We would also tender our thanks to assistants of both Departments for help given to us during the preparation of this article.

It is probable that by the time this article appears in print the whole of the concreting work will have been finally completed. On Tuesday of this week there was, so we were informed, not more than enough to take two days to accomplish still remaining to be done. On Saturday of last week pumping operations were commenced, the water being delivered into the western, or Buckingham Palace end of the lake, which is separated by means of a concrete dam from the eastern part. The latest report showed that with a maximum depth of water of about 1ft. 9in. there was no sign of leak whatever. The dam, of which mention has just been made, has been formed for the purpose of permitting one or other part of the lake to be drained for cleansing purposes, without the necessity for emptying all the basin. Its crest will, when the lake is completely filled, be submerged by about 1ft. and its presence will effect a considerable saving in water.

We may explain that, as regards the permeability to water of the concrete, sample slabs were made at different periods of the work, and that when they were thoroughly matured they were tested under a hydraulic pressure of 100 lb. to the square inch, or the equivalent of the pressure exerted by a head of 230ft. of water. In no case was there more than a mere trace of water observed on the surface of the slab remote from that on which the pressure was being applied.

* No. I. appeared July 20th.

SOUTH-EAST LANCASHIRE ELECTRICITY SUPPLY.

The first meeting of the South-East Lancashire Electricity Advisory Board was celebrated on Thursday, 19th inst., by a luncheon at the Midland Hotel, Manchester, at which Sir John Snell, the chairman of the Electricity Commissioners, was the chief guest. There were present about 250 representatives of the authorities interested, and Alderman Dagnall, chairman of the Board, presided. The toast of "The Electricity Commissioners" was proposed by Alderman Walker, who said that the Commissioners had so far gained the complete confidence of all concerned, but that they had many difficulties to surmount. He gave as instances the problem of the London supply and that of other areas in which for many years a "cat-and-dog" existence had been maintained between authority and authority or company and authority. In this respect, he said, South-East Lancashire need not put on sackcloth and ashes. They in that area had succeeded in eliminating the old spirit of municipal boundaries, which would not do for the fundamental principle of electricity supply.

In replying to the toast, Sir John Snell alluded to the difficulties which the Commissioners had had to face. He said that had he foreseen them he would probably have declined to take up the duties which he now discharged. It was astounding to think that an industry, the first law concerning which was passed so recently as in 1882, should be such a complex business as it is to-day. It was not, he continued, an easy matter to provide machinery which would meet with fairness and equity the rights and duties which had devolved upon authorities and companies, to reconcile them and bring into being some simple organisation and administration. The Lancashire problem was fairly easy, but London was very different. There, all sorts of bodies were concerned. Another difficult instance was that of North Wales and Chester. The Commissioners, he continued, had already considered 1500 separate applications for loans, involving £40,000,000; but, he added, with the goodwill of the electrical engineers to the undertakings and of the administrators, the Commissioners would be able to bring about a revolution in the development of the electrical supply of this country.

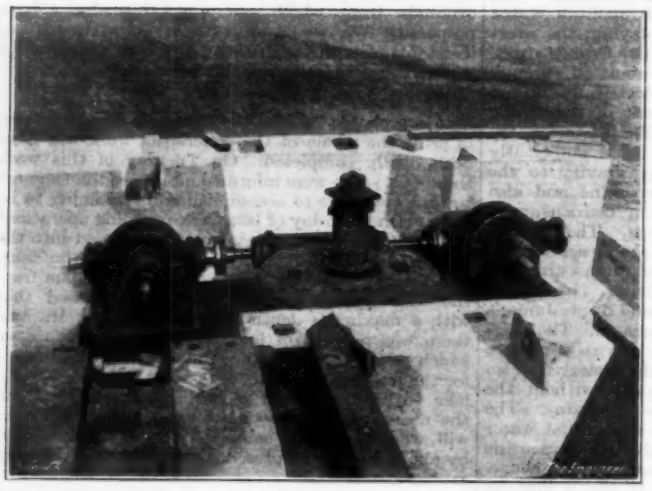
In proposing the toast "The South-East Lancashire Electricity Board," Alderman Higham (Blackburn) said that the area administered by the Board included one-tenth of the population, one-tenth of the rateable value, and about one-tenth of the whole electrical plant of the United Kingdom. It embraced 100 authorities.

Mr. S. L. Pearce, replying to the toast of "The Engineering Advisory Committee," of which he is the chairman, said that under the scheme the machinery had been set up which would bring about unified control of operations and extensions. They had already made considerable progress. For the first time in this country a definite attempt had been made to set down on scientific lines the basis on which charges should be made. For several months they had been engaged in the co-ordination of the "running" hours, a problem which called for close co-operation, and would make a test of the principles on which the Board was constituted.

The Council of the Institution of Railway Signal Engineers has made Mr. A. T. Blackall, who has just retired from the position of Signal and Telegraph Engineer, Great Western Railway, an honorary member. Mr. Blackall was its first President. The Council, at the same meeting, elected its first lady member—one of the staff of the Great Western Signal Department.

THE "NEVER-STOP" RAILWAY AT SOUTHEND

(*For description see opposite page*)

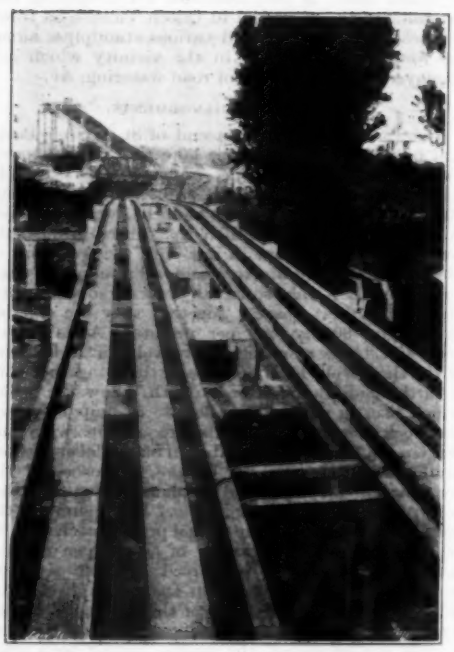


GEARING AT EAST END

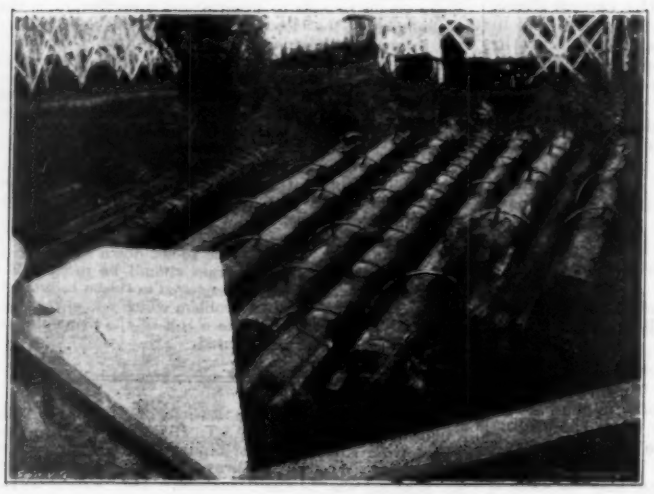
ONE OF THE CARS

VIEW OF TRACK LOOKING "UP"

ERECTING THE SPIRAL



VIEW OF TRACK LOOKING "DOWN"



A GROUP OF SPIRALS

END CURVE AT WEST END

The "Never-stop" Train System.

FROM time to time since it was first described at the British Association meeting at Portsmouth in 1911 (see THE ENGINEER, September 11th and December 22nd, 1911), the world has heard something of the remarkable scheme for central area passenger service devised by Mr. Yorath Lewis, M.I. Mech. E., and his associates in "Never-Stop" Transit, Limited, but with the exception of the small experimental railway erected at Ipswich there has, hitherto, been no chance of seeing how this ingenious plan would work out under practical conditions. That desideratum is now on the point of fulfilment, for a "Never-Stop" railway is being built in the Kursaal Grounds at Southend-on-Sea, and is likely to be ready for use in full public trial during the approaching August Bank Holiday. The line is some 300 yards long, and it is so arranged that it will demonstrate completely the ability of the system to change gradient and to take curves of short radius. It is believed that it will show also that railways constructed on this principle are practically "silent"—that is to say, by contrast with other railways or tramways. The line consists of two parallel tracks about 6ft. apart from centre to centre. One of them will be the "up," and the other the "down" line, and the carriages will travel continuously round the circuit. It is a remarkable feature of the system that large radius loops are not required at the ends, for the up and down lines are connected by bends of no more than 3ft. radius. The economy of space and material which results from this fact alone is considerable.

Amongst the many remarkable features of this Southend railway are its high and graduated rates of acceleration and deceleration; its regenerative braking action; its very high scheduled speed having regard to the short distance between stations, and its passenger carrying capacity, which amounts to no less than 18,000 per hour in each direction.

It is desirable to recall quite briefly the principle on which the "Never-Stop" railway works. Imagine, then, a long screw laid between the running rails and rotate this screw at a constant speed by any suitable means. From the underframe of the coach depends an arm carrying two rollers that engage with the screw-thread or spiral. Imagine, furthermore, that the spiral has variable pitch; that at certain places the pitch is very fine, whilst at others it is very coarse. It is obvious that the speed of a vehicle will depend upon the pitch of that part of the screw with which it happens to be engaged. It will crawl whilst upon the fine pitch, and will accelerate as the pitch gets coarser and coarser. Let us suppose that the speed of rotation of the screw is such that at the positions of the finest pitch the vehicle makes 1½ to 3 miles an hour. Then, if we provide a suitable platform at this position, passengers can as readily enter, or alight from, the car as they now board or leave the familiar escalator. As the car moves out of the stations it may be rapidly accelerated up to, let us say, 24 miles per hour and then smoothly, but swiftly, decelerated as the next station is approached.

So far for one coach. Consider now the case of a train. It is easy to imagine a coupled train with a single engagement, but a better plan is to make all the vehicles engage the screw independently of each other, as by so doing the driving pressure between thread and roller may be distributed over several engagements. In this case we have a very interesting condition of affairs. Imagine the coaches all practically in contact in a station; as the first one moves out it begins to accelerate and runs away from its successor, the second coach runs away from the third, the third from the fourth, and so on, until by the time all the coaches are out of the station they are spread out at varying intervals along the line. When a station is being approached, the reverse conditions obtain; No. 1 slows down and is caught up by No. 2, and so on, so that the train, when in the station, is in close formation once more.

A little consideration, helped by a few simple calculations, will show at once that, owing to this remarkable feature, it is possible, by putting the right number of coaches on the railway, to have a train always in all the stations. That is a very important feature of the system.

Enough for the moment has been said with regard to the principles of the "Never-Stop" system; let us look at some of the practical details, for it is upon them that success depends. We are able to reproduce some photographs of the railway under construction, and from them a good idea of some of the essential points will be obtained. The driving screw is the most important detail. At Southend it consists of a stout steel tube from which short steel spokes project. These spokes are arranged spirally on a uniform or variable pitch as required, and to their free tops is secured a spiral steel rail or bar of substantial section. In one of our views a number of lengths of spiral shafting can be seen. Each length is about 12 yards long, and is supported in ball bearings at each end. Diaphragm couplings are provided to allow for expansion, &c., and where a change of direction either in the vertical or horizontal direction takes place a pair of crown gears is introduced. To the practical mind the question will at once arise how the bearings can be interposed without breaking the screw thread. The device is a very ingenious one, which in due time we shall illustrate. For the moment we may say that the ends of the thread are prolonged and joggled to overlap accurately, the one being bent outwards and the other inwards. Thus a space is left into which a suitably "cranked" pedestal for supporting the ball bearings can be introduced.

Another question that will arise is how the very short radius curves at the ends are negotiated? At these points the screws come to an end and the coaches are literally taken in hand by an arm mounted on the vertical axle of a worm wheel geared to the shafts. The movement at these ends is, of course, very slow. One of our views shows the gear case at one end with the worm wheel in the centre and the reducing gear for the two spirals at each side. The motor is not in place in this view.

In another view one of the coaches is seen, and from it the ample accessibility will be noticed. Each coach will accommodate eight people sitting and four more standing. The truck beneath each coach body consists of two single-axle bogies, whose wheels are flangeless and shod with thick rubber tires which run on track rails laid upon concrete piers. It carries also four guiding wheels, also provided with rubber tires, which run in a central guide track or groove; and two driving rollers which engage one on each side of the spiral thread. The last-named are supported in a spring frame and, in order to minimise vibration and noise, a thick rubber sleeve is placed between the roller centre and its tire, which is of special steel. All wheels and rollers are carried in ball bearings.

The driving plant consists of a D.C. motor at each end of the line, both being governed by an electrically operated contactor controller worked automatically by four press-buttons at either of the stations. Kinetic braking of the motors is not attempted in this small railway, but each motor is fitted with a solenoid brake capable of bringing the entire system to rest in a few seconds.

Such, in brief outline, is an example of one of the most daring and ingenious attempts to solve the ever-increasing traffic problem which we have witnessed. The trial railway at Southend is big enough to demonstrate the practical elements of the system. It will be watched with the closest attention by engineers and traffic authorities for some months to come, and in the event of its attaining the success which is anticipated, the system will demand careful consideration for extensive applications. It is amongst the few schemes selected by the Municipality of Paris in the world-wide competition set up last year as standing a chance of one of the big prizes offered. It is significant that the Ville de Paris experts are seeking developments on the lines of the continuous plan of operation, in which direction there are considerable prospects of higher schedule speeds and very much lower initial and operating costs.

The time has not yet arrived for us to speak of the "Never-stop" system with confidence, but from an inspection of the drawings we may praise the ingenuity and perseverance of the designers and express a general approval of the whole, whilst, as regards metropolitan passenger traffic, we can only say that if half the results which Mr. Yorath Lewis' figures indicate are attained in the actual tests, then the system will enforce the attentions of all concerned in the traffic problems of London, Manchester, Paris, and many other big cities throughout the world.

The Alkali, &c., Works Report.

THE fifty-ninth annual reports under the Alkali, &c., Works Regulation Act, 1906, by the Chief Inspectors for England and Scotland for 1922, presented to the Minister of Health and the Scottish Board of Health respectively, are now before us. As in the case of the post-war reports of the Chief Inspector of Mines, that under notice is a very meagre volume compared with those of former days issued by Mr. A. E. Fletcher and Mr. R. Forbes Carpenter. This defect, however, does not lie at the door of Mr. T. Lewis Bailey or Mr. J. W. Young, the Chief Inspectors for England and Scotland, but results from circumstances too well known to need mention. Taking up some previous reports at random, we notice that that for 1891 consisted of 112 pages, while the 1903 report ran to 183 pages, obtainable at the price of 9d. To-day, while the subject matter as a whole—including some laboratory researches—is treated on old lines, the main difference is the absence of separate reports by the Sub or District Inspectors, as to whose identity nothing is revealed. Presumably they are still holding their positions or carrying out their duties as in pre-war days, but minus the flash of limelight which used to bring them before the notice of the reader interested in applied chemistry.

The amended Act of 1906 brought under the control of the Inspectors several processes, notably those conducted in smelting and allied works, which had not previously come into the schedule of registerable processes. It would seem, however, from the Chief Inspector's remarks that the great bulk of the complaints made by the public to-day come from chemical works which are not compelled by law to register. With regard to such works, although the alkali Inspector has no jurisdiction, he makes it a practice to investigate complaints, and has frequently found himself in the position of being able to give valuable advice both to local authorities and to the manufacturers concerned. As new processes are bound to be evolved from time to time in manufacturing chemistry, it is clear that any Act specifying the particular processes to be registered must require amendment at frequent intervals and the expeditious procedure of Orders in Council suggests itself as desirable where it is merely a case of scheduling a new process which in the opinion of the Chief Inspector ought to be scheduled. Despite the penalties attaching to failures to register, the report states that several firms had been found as in previous years who had not taken the necessary steps prescribed by law in the interests of the public. It has always been the endeavour of successive Chief Inspectors to work amicably with the manufacturers, and there are, we imagine, few among the latter who are not prepared to testify to the assistance afforded by the inspectorate in the attainment of greater efficiency, because in combating nuisances, such as the escape of acid, gases, or dusts of one sort or another, economy is usually one of the effects. Without giving away to a competitor the details of processes which they have inspected in the course of their duties, the Inspectors can from their wide experience of chemical engineering often be of assistance in suggesting the most appropriate measures of reform to a manufacturer who has unwittingly given cause for complaint. In 1923 serious trouble seems to have been experienced only in the case of two works as regards atmospheric contamination, but considerable improvement is reported as the result of greater attention to the details of working.

Special mention is made in the report of a few of the more important processes under inspection, and a word or two of comment may not be superfluous. With regard to cement works, where the most serious nuisance is said to be due to dust, it is stated that, while good depositing chambers are usually sufficient to obviate any serious trouble, it is more satisfactory to use bag filtration. Without wishing to deny the utility of a good bag-house, it seems clear that very satisfactory results can be obtained without it, provided that the commonly used depositing chambers are really good and well looked after. It is indifference and carelessness on this head that has led to so much trouble. With regard to the advantages of the vertical kiln over the horizontal calciner as a fuel saver, it would seem that some difficulty will be experienced in getting cement manufacturers to convert their plant.

Reference is made to the increased use of sulphur in place of pyrites in the manufacture of vitriol, this being an outstanding feature of last year. We commented on this matter in a leader last August, since which time the American and Italian sulphur producers have come to an agreement regarding the sale of sulphur, and the leading pyrites mines in Spain and Portugal have come to a pooling arrangement as to the disposal of their output. The future competition of sulphur and pyrites as the raw product of the vitriol manufacture will be watched with interest, but it should be noted that besides the always important factor of price the use of sulphur has the advantage that it renders the unpleasant operation of de-arsenication unnecessary. In the alkali manufacture the ammonia process now reigns supreme, but the passing of the Leblanc process has by no means stopped the decomposition of salt by sulphuric acid, as salt cake is required for various industries. One use which has in recent years shown considerable expansion is in the manufacture of sodium sulphide, now so largely used in sulphur dyeing. Hydrochloric acid is, of course, also in regular demand for such industries as galvanising and fibre separation, though its production by the electrolysis of brine is now an established competitive process.

With regard to the acidity of chimney gases, the regulation of which has from the first been the main *raison d'être* of the Alkali Acts, the figures given in the report show that satisfactory results continue to be obtained, except in the smelting works, where the calcination of zinc blende is carried on. Thus while the acidity of chimney and other gases in terms of sulphuric anhydride averaged one grain per cubic foot for all chimneys under inspection, the figure for the chimneys of smelting works was 3.17 against 1.73 for 1921.

Although in pre-war days zinc concentrates from North Wales were commonly calcined at the vitriol works at Flint and the sulphur converted into acid, the calcination problem has been intensified since by the large importation of zinc concentrates on Government account from Australia. It is pointed out in the report that difficulties have arisen through the amount of lead in the imported concentrates rendering it difficult to remove the requisite amount of sulphur without a high temperature final roast. Furthermore, if the calciner gases are employed in the vitriol manufacture, volatilised lead compounds are apt to cause considerable trouble in the Glover towers, where they collect and form obstructions. The subject is receiving the Chief Inspector's close attention, and it is stated that improvement may be

looked for as regards the acidity of the chimney gases at no remote future. Further, where the gases are not converted into sulphuric acid it is hoped to supersede the ordinary methods of calcination altogether, and the capabilities of some recently proposed methods of doing this are to be closely examined.

Speaking of sulphate of ammonia and gas liquor works, now in such large number owing to recovery coke oven plants and the plants at gasworks, the Chief Inspector makes some reflections on the procedure commonly met with. It is not edifying, he says, in these days of scientific control to reflect on the somewhat haphazard methods prevailing in so many sulphate of ammonia works; by-products ought surely to be manufactured under as economical conditions as possible compatible with quality of the article produced. Points specially requiring attention, he says, are the quantities of lime and steam used in the still, both being commonly used in far greater excess than there is any need for. This matter is of special importance because of the long-standing trouble in the disposal of the effluent spent liquors from the ammonia plants at gasworks and coke oven works. These spent liquors have been a source of trouble up and down the country at sewage purification works, and though important work was done by Fowler some years ago in showing that the sulphocyanides could be rendered innocuous, the trouble generally has still remained acute. In the report for 1921 some special information relating to this topic was given, and this is continued on six or seven pages of the present report, particular reference being made to the experiments now being made at the Hornsey gasworks, where the de-phenolated liquor is being submitted to bacterial action.

Another matter involving research which has received attention at the Chief Inspector's laboratory is the pickling process in the manufacture of tin-plate, and several pages of the report are taken up with an account of the experimental work. We can only say a word or two here, and doubtless those interested will obtain the report and study it. The pickling process, which is the removal by sulphuric acid of the oxide scale from the mild steel plates preparatory to their being tinned, has usually been carried out by direct treatment with acid, which, while removing the scale, attacks the steel also with the evolution of noxious gases. Gradually the practice of adding some body known as a "restrainer" was introduced, but no detailed research was made to elucidate the *rationale* of the process. The present research is therefore opportune, as the number of different "restrainers" has multiplied, and information as to which is the most economical is a matter of importance. It is also interesting as being a research in practical colloidal chemistry. A colloid is necessary for this restraining process, and glue has been used for some years. As, however, it is decomposed by the acid into xanthogenates its substitution by some substance which retains its powers longer is desirable. Among the bodies experimented with were size, dextrine, glucose, cresol and Pickelette, comparison being made of the efficiency of the various restrainers under controlled conditions. The tests, it is specifically stated, were not made with the object of obtaining evidence for promoting the use of any one substance, but of providing data for the guidance of those who may be interested in perfecting the pickling process as carried on to-day in English practice. We may mention, in concluding our notice, a reference by the Chief Inspector for Scotland to the fact that fluorine is found as a regular constituent in the gas liquor from the coke ovens of the Plean Colliery Company, near Stirling. By reason of its corrosive action on metal it has been adjudged desirable to remove it before recovering the dissolved ammonia. The Inspector says he is not aware that such an occurrence of fluorine has been previously observed, and doubtless he would be interested to be notified of any publication referring thereto.

SIXTY YEARS AGO.

TURNING to our issue of July 24th, 1863, we find an interesting leader in which the relative merits of the beam engine and the horizontal engine were discussed. At that time, we learn, there was an unaccountable prejudice on the part of cotton spinners, corn millers and brewers against horizontal steam engines. For the purpose of comparison two engines, made by Messrs. Mirrlees and Tait, of Glasgow, were taken. The non-condensing beam engine was that which was exhibited by the aforementioned firm at the International Exhibition of 1862, and its weight and dimensions were contrasted with a horizontal type engine, of the same power, built by the same makers and intended for the same purpose, namely, driving a large sugar mill. The beam engine had a 22in. cylinder and a stroke of 4ft. 6in., while the horizontal engine had a cylinder of equal diameter with a 4ft. stroke, and developed the same power at a slightly higher speed. The whole weight of the beam engine was 44 tons 9 cwt., whilst that of the horizontal engine was slightly less than 20 tons. We found that the beam engine was heavy and costly; it required expensive foundations and a great deal of room with no compensating advantages, and contended that given excellence of material, care in design and proportion and good workmanship, the horizontal engine would appear to be more deserving of preference.

The problem of London traffic congestion would not appear to be exactly a new one, for we read evidence given before the Select Committee on the London City Traffic Regulation Bill, which gives a curious account of St. Swithin's-lane, leading from near the entrance of Lombard-street to Cannon-street. It was so constantly blocked up as far as the passage of vehicles were concerned by vans loading or unloading that a police watch on three successive days recorded the following result: "On the 29th of June last, in the ten hours between 8 a.m. and 6 p.m., the street was blocked up for eight hours and twenty-five minutes, and only open for one hour and ten minutes, and on July the 1st, the state of things was substantially the same. On the 30th of June, the street was only closed for eight hours and thirty-five minutes, and open for one hour and fifty minutes." Our brief note on this subject closes with the statement that two years hence there will be a great railway station near the Cannon-street end of this thoroughfare.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

RAILWAY SPEEDS.

SIR,—The accuracy of the statements in your editorial article on "Economic Railway Speeds," July 6th, 1923, is as undeniable as is Major Horace Myers' case, July 20th, page 70, for a progressive policy of much higher train speeds up grade, higher average speeds and probably lower speeds on the falling grades, just where the sensationally high speeds are invariably made. With motor petrol now almost at pre-war price—alleged to have been brought about by the fear of new processes for cheapening motor alcohol—the railways have to face cheaper road transport with high competitive speeds, so that they would probably be well advised to spend some thousands of pounds less on expensive pictorial advertising and make a stronger bid for public custom by means of much higher train speeds with train loads 50 per cent. heavier than now usual, using the same engines as now and with the present fuel consumptions. This is realised every day in continental train services; yet while we have the heavier and stronger roads, with heavier locomotives, there is still nothing in the whole of this country approaching to the high speeds, heavy loads and low expenditures of the engines whose results are recorded on page 509, June 18th, 1917—made about nine years ago—on a line rising 1060ft. on a length of 82.5 miles. If anyone will take the trouble to refer back to that page he will find that, for a similar 80-mile bank, with a train of 487 tons (J), our newest engines would also average about 50 miles per hour with a similar consumption of 21 lb. water per indicated horse-power hour, a splendid performance for any locomotive of this class and system; whereas the same type of engine, but utilising its exhaust steam for "boosting" the train, permits the load to be increased to 645 coach tons and run at an average speed of (P) 49 miles per hour in consuming 13.5 lb. water per horse-power indicated per hour, the rate at the draw-bar being rather less in proportion to the indicated power. In hauling 645 tons while utilising the exhaust steam for power, one ton of coal less is required than when hauling 487 tons with the standard system locomotive in Britain or in France. With equal loads for both engine systems the one which utilises its exhaust steam runs at very much higher average speeds, but with a lower coal consumption.

If the reader will now visit South Kensington Museum, Mechanical Section, he will see how students are taught to understand how this vast difference in load and speeds comes about. This is shown over Room 3, as a kind of frieze, in the form of very large diagrams from the pressure indicator, coloured in red (H.P.) and blue (L.P.), exhibiting the increase in M.E.P. in piston tonnage and in tractive power by utilising the exhaust steam for power, the M.E.P. for equal initial pressures being 100 simple and 89 + 89 = 178 compound, the cut-offs and speeds being equal. Other examples, made at different cut-offs, are also given, and the tonnage indicated on the pistons for any cut-off down to 30 per cent. is, in general, over 50 per cent. greater when the exhaust steam is utilised for increasing the tractive power. As superheated steam is now commonly employed, it would be useful to have these present examples, from saturated steam, supplemented by diagrams from recent practice on the same steam cut-off and steam pressure. At 60 miles per hour the tractive effort in compound expansion is shown by recent indicator cards to be equal to that at 30 miles per hour in single expansion. At 80 miles per hour the compound indicated tractive effort equals that at 40 miles per hour in single expansion, &c. &c., this being conclusively shown by strings of indicator cards taken from one and the same locomotive on the Swedish State Railway, which can be instantly made to work by either system at any speed by merely touching a trigger; and scores of other indicator cards are now available proving that the utilisation of the exhaust steam vastly increases the speed and haulage capacity of any locomotive in reducing its water and coal consumption and also in lessening the annual cost of repairs by 30 per cent. through the reduction in the maximum initial stresses on the reciprocating and revolving parts. Mr. Vauclain, in the United States, recently claimed that at 50 per cent. cut-off it reduced the steam rate per indicated horse-power hour to that of some modern electric power station condensing plants. In Britain it would enable 600-ton trains to be run at higher speeds than 400-ton trains are now, and without any increase in fuel consumptions. Before the exhibits over Room 3 in the South Kensington Museum annexe are taken away, practising engineers and students interested in high train speeds with heavy trains, at a cheap haulage rate and with enormous locomotive power per ton of engine weight—28 indicated horse-power instead of 19 or 20 indicated horse-power per ton—should study those tableaux of indicator diagrams from locomotives.

CHARLES R. KING.

July 23rd.

SIR,—The subjects of railway engine power and speed are again attracting attention. I wonder if this is due to our old friend, "the iron horse," being threatened by a rival, and its being anxious to prove that it has still some go in it? Personally, I think it will do much better work yet.

It is not at all easy to get records of what is being done, because nobody can tell when it is coming. A driver may start out with a moderate load, and after being hindered by signals until he is considerably behind, may, later on, find things just right for a sprint—good road, good weather, engine in best form—and so a bit of record-breaking is done, with nobody there to make a note of it.

I remember a driver explaining matters one night before he started out with a mail train. He got off his engine to take a good look at his train, then at the weather, then at the coal on his tender, a few words with the fireman, and he said, from what he could see of it, that he could get in, if he tried to, an hour before time.

If some combination of locomotive, marine and motor car engineer were permitted to try what he could do, I think a very powerful engine would be the result. The loco instinct would see to the vehicle, the boiler, and such like; the marine instinct would get rid of back pressure by using a condenser, and the motor car instinct would see to the valve gear, making it possible to advance or retard the steam admission as speed required it, and get rid of all wire drawing. And if the electrical engineering instinct, with its "parallel working," could add a booster engine, so much the better.

Some years ago, thinking at the time I was the first inventor of the uniflow type of steam engine, I suggested it to a prominent railway man. I suggested also retaining the valve gearing as at present used, but altered a little in its results. I would allow the steam to escape through the middle opening in the cylinder to the blast pipe for the fire, and as soon as this opening was covered by the piston, on its return stroke, the exhaust valve would open to a small condenser, not only getting rid of back pressure, but I hoped also to get some useful negative pressure as well. I got a rather severe reply of the "It can't be done" sort.

The difficulties were all imaginary ones—it was not possible to carry water to condense the steam from a 1500 horse-power engine; the long uniflow cylinders could not be got in anyhow; back pressure was essential for cushioning, and so on.

My next suggestion was for a booster engine driving one pair of the large driving wheels by an automatic clutch, working in the forward direction only, this to allow of free wheeling when steam was off the booster; the suggestion included a substitute for the connecting-rods between the wheels. I had no better luck with this. The connecting-rods could not be omitted; the clutch would slip, or, at best, it would be wrecked in a week by the terrible jars when the booster caught up with the main engine when it was used to give a lift up a bank, or to get up speed again after a slow down for a signal.

I have never found courage to suggest my ideas for valve gearing operated, not by any mechanical gearing, but by steam, as this includes returning the valves to their closed position by a spring, just like an oil engine. This is quite unthinkable as things are at present.

A difficulty in the way of faster speed is the bad system of signals at present in use. I suggested some months ago that any signal which was intended to convey information to a driver should be made on the engine, and that it should be such that the driver could repeat it, to show that he had it correctly. There have been several disasters since then, which would not have happened if the drivers had been made aware of what was in front of them in each case. I still think, as I thought then, that the signal should be equal to what a driver can see for himself along a straight road on a clear day. The signals from one cabin to another are not fixed on posts by the side of the line; why, then, should those for drivers be fixed on posts?

Southsea, July 24th. J. JACKSON.

RAILWAY ELECTRIFICATION.

SIR,—Your suggestion that the London, Midland and Scottish Railway Company intends to electrify the line between Preston and Carlisle is somewhat alarming. In the first place, it is always a mistake to electrify part only of a through route. Everyone who uses the Aylesbury line of the Metropolitan Company knows how irritating are the delays at Harrow caused by the change over from one system of traction to the other, and as the important expresses have for many years run between Crewe and Carlisle without a stop it would be foolish to introduce a serious cause of delay at Preston.

Then there is the question of expense. THE ENGINEER for June 9th, 1922, told us that the electrification of the St. Gothard line was estimated to have cost no less than a million Swiss francs per kilometre, and even if this appalling figure were not reached, when interest had been paid on the sum laid out in electrification, there would be nothing left for dividends.

Before embarking on any such wild cat adventure the company would be well advised to try what can be done with a really efficient steam locomotive. I have known this line for more years than I care to remember, and have seen all the classes of express engine employed on it: McConnell's "bloomers," Ramsbottom's "Lady of the Lake" of 1859 and "Newton" of 1866, Webb's "Precursor" and "Precedent," the various three-cylinder and four-cylinder compounds, and the twentieth century engines down to the "Claughtons" of to-day, and, except perhaps for a short period in the 'seventies, in the whole dreary history there has never been a time when the engines were really master of the trains. The French compounds and our own Great Western Company have shown what can be accomplished even by comparatively small engines if only they are allowed the advantage of high-pressure steam, and it is absurd to say that because a pressure of 175 lb. was considered by Mr. Webb to be sufficient in 1884, that pressure must not be exceeded in 1923, no matter what the resulting waste in double-heading may be.

With the advent of new control at Crewe it is to be hoped that we shall once for all break with the old tradition that the engines shall never be quite equal to their work.

London, July 21st. W. B. THOMPSON.

THE AKROYD-CYCLE ENGINE.

SIR,—My attention has been drawn to a statement of Mr. Herbert Akroyd Stuart published in your issue of June 1st, in which it is said that in my paper on "High-speed Oil Engine" the statement is made "that the Akroyd cycle, the 'Hornsby-Akroyd' is a low compression oil engine and that engine cycle is obscure." I beg leave to state that no passage in my paper contains any such reference as is attributed to me, and, hence, Mr. Stuart's contention that I have made a wrong and misleading statement cannot be based on the actual contents of my paper, or on the extracts from my paper which were published in THE ENGINEER of February 23rd, but most probably on some condensed and, in this instance, garbled account of my lecture.

J. L. CHALONER.

London, S.W. 1, July 21st.

Railway Matters.

IT is reported that the first Siberian express train to be run to Vladivostok since the collapse of Russia will shortly leave Petrograd. The journey between the two places is expected to last a fortnight.

A VERDICT of "Accidental Death" was returned on Tuesday last at the adjourned inquest into the death of the two passengers and two enginemen killed in the collision at Diggle—London, Midland and Scottish Railway—on the 6th inst.

THE proposal to extend the City and South London tube railway to Morden, which was rejected by the Lords' Committee, is, for the time being, dead, but a compromise has been reached with the Southern Railway Company by which the line will be carried to Merton.

THE Government Bill for the construction of a number of branch lines of the Canadian National Railways during a period of three years at a cost of approximately 28,000,000 dollars, as recommended by Sir Henry Thornton, which was passed by the House of Commons, was rejected by the Senate on June 29th by a vote of 47 to 10.

THERE has recently come into our possession a pamphlet of sixteen pages which was compiled last March when the London, Brighton and South Coast Railway Company was having its final meeting. It contains a brief history of the company, has views of the former and present stations at Victoria, London Bridge and Brighton, early and modern locomotives, and a list of all the directors, chairmen and chief officers.

ANSWERING a question on the 11th inst., Colonel Wilfred Ashley said that the Ministry of Transport had recently called the attention of the railway companies to the fact that unemployment was likely again to be serious in the coming winter. The companies will, no doubt, take this state of affairs into consideration in determining on the schemes of electrification or other new works with which they may be in a position to proceed at an early date.

THE paper by Mr. J. S. Moore on "The Theory of Interlocking," read at the Institution of Railway Signal Engineers on the 18th inst., inspires the thought that the first interlocking was done by John Saxby in 1856. This was, however, only sequence locking, *i.e.*, making one lever precede another. The locking between conflicting levers was not achieved until it was done in 1860 by Austin Chambers. A remarkable fact about interlocking is that it is still performed mechanically. Electricity is used in many phases of signalling and, even where it or any other power is employed for the actuation of points and signals, the levers controlling such operation are interlocked mechanically.

THE peculiar situation in which certain of the Irish railway companies, particularly the Great Northern, find themselves owing to part of their system being in the Free State and part in Northern Ireland, has before been mentioned in THE ENGINEER. This situation is not improved by the fact that consolidation of the railways in the Free State has been recommended. It is of interest, therefore, to hear that Mr. Cosgrove and Sir James Craig, the leaders of the respective Governments, met in London on the 17th inst. by mutual agreement for the purpose of discussing the question of railway transport. The official announcement as to this meeting having been held adds that it was decided to hold a further conference at a later date.

INFORMATION to hand since the paragraph in a recent issue was written, shows that the breach in the Aviemore direct line of the Highland section was 100 yards long and 40ft. deep. The damage appears to have been done by the Bogbain Burn, which was diverted when the line, opened in 1897, was constructed. The late Colonel Druitt, when reporting on the disaster of June 18th, 1914, near this spot, said "there was further damage done to the railway at a point 228 yards north of the railway bridge where the embankment partially subsided. There had been a diversion of the burn here, and the embankment was on the site of the old bed of the burn; the flood water evidently tried to follow the old course." The same thing has happened again; the flooded stream sought the straight path.

THE majority of the block instruments on railways are actuated by three wires—one for the up line block signals, a second for the down line, and a third wire for the bell which is common to both lines. These wires cost about £20 per mile per wire to install and about 25s. per mile per wire per annum to maintain. Block signalling can, and is, efficiently worked by one wire, and thus on 100 miles of railway £4000 are saved in the installation and £250 a year in the maintenance. The saving does not stop there. The telegraph poles and wire lines are less occupied, which is important at this time when the telephone is so much used and the poles and wires are less susceptible to damage by wind, ice and snow. Interrupted communication is more quickly restored and there is also less consumption of current, as communication by one wire is by means of momentary currents; with three-wire instruments the current is always flowing.

TWENTY years ago to-day, *i.e.*, on July 27th, 1903, there occurred the worst buffer-stop collision on record in this country. A special train from Ardrossan was, on arrival at St. Enoch's Station, Glasgow, turned into the new side of the station, where the platform lines were shorter than those on the old side. There was a speed restriction of 10 miles per hour approaching and entering the station, but the driver was running at 12 or 15 miles per hour, and the engine was only about 45 yards from the buffers when the fireman reminded the driver that they were running on the new side. The train could not be stopped in time and struck the buffers with great force. The second coach was telescoped into the first, and sixteen passengers were killed. Sir Arthur Yorke's report was noteworthy in that it pointed out that whilst railways abroad had taken advantage of the improvements made in the Westinghouse and vacuum brakes whereby their rapidity of action had been largely increased, and the stopping distance or time proportionately reduced, these improvements seemed to have been ignored in the United Kingdom.

Notes and Memoranda.

THE reinforced concrete girders which have been used in the construction of the new Los Angeles theatre, and are of 126ft. span, are claimed, in the *Engineering News-Record*, as probably being the longest of their kind ever built.

A DEVICE which directly conveys to the eye the principal statements and results of Einstein's original (restricted) theory of relativity, has recently been perfected by Professor Karapetoff, of Cornell University, and is dealt with briefly in the July issue of the *Journal* of the Institution of Electrical Engineers.

WHAT appears to have been quite an unusual accident happened in Arkansas last June. A flood, which covered parts of the town to a depth of from 2ft. to 15ft., invaded a storage house containing some 6000 tons of ice. The water melted away the lower part of the pile of ice, which tipped over and wrecked the reinforced concrete building in which it was stacked.

OFFICIAL statistics recently compiled in Moscow show that the total water power resources of Russia amount to about 20,000,000 horse-power; but only 586,000 horse-power can be obtained in European Russia. The largest amount of power could be developed in Caucasia, viz., 7,715,000 horse-power, while Southern Siberia comes next with 5,000,000 horse-power.

As the result of tests the Puget Sound Power and Light Company, U.S.A., decided to equip ten boilers, having a total rating of 4100 horse-power, for use with powdered coal. More than 190,000 tons of this fuel has been burnt, with an average boiler efficiency of 80 per cent. The coal used is refuse which has accumulated at the company's mine during twenty years. This is washed at the mine, reducing the ash from 25 to 12 per cent. The operating cost of preparing the fuel is about 71 cents per ton.

CONSIDERABLE trouble was caused at an American water power plant by the 6ft. penstock becoming frozen up during the winter. To stop it the engineer drilled ¼in. holes through the pipe, on the top, at about 12ft. centres. The water escaping from these holes froze outside the pipe and protected it from freezing. In the spring the holes were automatically closed up again by the suspended matter carried by the water at that season, but could be easily cleared with a pricker on the approach of winter.

COMMENTING on the belief, which has been expressed in some quarters, that the United States are securing a lead over British manufacturers in the supply of textile machinery to China, the *Journal* of the British Chamber of Commerce, Shanghai, points out that of the looms which it is projected should be installed the British share is roughly five times that of America. On the other hand, the Japanese proportion is slightly greater than the British. Taking textile machinery in general, the imports during 1922 were, roughly, in the proportion of Great Britain 15, Japan 7, and America 6.

AFTER taking 21,000 photographs, Messrs. W. D. Harkins and R. W. Ryan have obtained a picture of the atom in collision. By using high-speed Alpha particles from thorium they secured two views, taken from directions perpendicular to each other, of a collision between one of these particles and the nucleus of an atom of air. Their object, as they explain in *Nature*, was to photograph the disintegration of the atom and test its stability. The photograph shows the original track splitting into three branches at the point of collision, which is exactly the characteristic to be expected if the bombarded atom disintegrates.

FROM a recent report of the Bureau of Mines it appears that there is a lack of explosion-proof mining machinery in America. It is stated, for instance, that there are some classes of mining machinery in which not a single explosion-proof motor is to be found. Thus, the permissible list at this date does not include any longwall or arcwall machines, nor any approved motors for pumps, compressors, loading machines, or room hoists. There is also a great need for explosion-proof switches and terminal or junction-boxes at which to attach the ends of cables of mining machines. As yet the Bureau of Mines has not received any applications for the test of such apparatus.

THE question of how far to go with duplication of equipment and the installation of safeguards is one that plays an important part in central station design. The extent to which these provisions are made has an important bearing on the cost of installation and has a direct influence upon the dependability of the service rendered. Stations on larger interconnected systems require a greater degree of protection of this nature than is usually the case in stations on small systems on account of the importance of the service as well as the more serious results of short circuits, due to the greater concentration of energy. An article by Walter F. Sims in the July issue of the *Journal* of the Institution of Electrical Engineers discusses the more important considerations to be taken into account and points out that local conditions will have a determining influence on the decision made.

INVESTIGATIONS conducted by Mr. D. Harrington in metal mines in Butte, Montana, indicate that surface air temperatures have an important bearing on underground air temperatures in shallow mines, or close to a downcast shaft or an intake air course in deep mines above the 2000ft. level, particularly in those mines depending on natural ventilation. In deep mines, especially in those having mechanical ventilation, day to day, or hour to hour, variations in surface temperatures have very little influence on underground air temperatures below the 2000ft. level except in summer, when outside temperatures are greatly in excess of 65 deg. Fah. Even in deep mines, however, a seasonal variation below the 2000ft. level occurs, average summer shaft temperatures being 5 deg. to 10 deg. Fah. higher than the average winter readings. Rock temperatures undoubtedly affect air temperatures underground much more than do temperatures of outside air; on the other hand, air circulating underground has a well-defined effect on rock temperatures.

Miscellanea.

THE works of the Canadian Westinghouse Company are being extended at a cost of 1,500,000 dollars.

THE Royal Mint in Sydney, which is involving New South Wales in a loss of £7000 annually, is to be closed as from January 1st next.

THE erection of the sliding caissons for the new graving dock at Durban, Natal, has been started. The caissons, made by Sir W. G. Armstrong, Whitworth and Co., weigh about 850 tons each.

IN a large factory for the manufacture of woollen goods from local wool which has just been started at Harrismith, South Africa, all the machinery is of German make. The successful German tender was roughly one-fifth as great as the lowest one from Great Britain.

STATISTICS published in the report of the Ceylon Chamber of Commerce for the year ended December 31st last show a very satisfactory increase in the exports of plumbago from Ceylon during 1922, the total shipment being 211,235 cwt., as compared with 85,153 cwt. in 1921. There appear to be signs of a general improvement setting in slowly not only for dusts, but for the higher grades of plumbago as well.

THE commercial secretary at Bucharest states that the Prahava oil fields of Roumania contributed approximately 78 per cent. of the total oil production during last year, the Dambovita oil fields approximately 12.85 per cent., the Buzau oil fields 6.75 per cent., and Bacau 2.40 per cent. According to revised figures now available the crude oil produced in Roumania in 1922 amounted to 1,368,929 tons, as against 1,168,414 tons in 1921.

AT a meeting of the Dominion Marine Association held in Toronto recently, instructions were given to urge the Canadian Government to intervene and ask for prompt measures to restrain the diversion of more than the permitted amount of water from the Great Lakes through the Chicago Drainage Canal. The Association wants the diversion limited to 4187 cubic feet per sec., authorised at Washington in 1912, and greatly exceeded in practice.

IT is now some twenty years since it was first suggested that an observatory should be installed at Johannesburg, and it appears, from an article in *Nature*, that the establishment will soon be provided with a large refractor. The necessary optical glass discs, 26in. in diameter, have been cast by Chance Bros., and are now being ground under the guidance of Sir Howard Grubb at St. Albans. The mechanical parts of the telescope are practically complete.

IT is reported in the *Chemical Trade Journal* that Herr Stinnes intends to form a trust for controlling practically the whole of the German liquid fuel industry. Two of the four great combines, the activities of which Stinnes contemplates co-ordinating, are the holders of the patent rights of the Melamid and Bergius processes, which are the most important contributions to liquid fuel technology that Germany has made within recent years. Neither of these two processes has progressed much beyond the experimental stage, but it is known that their inventors and financial backers are confident of ultimate success.

IN his annual statement on the work of the Post Office Department made in the House of Commons on Tuesday last, the Postmaster-General referred to the problem of introducing automatic telephone exchanges into the London area. Although the problem was a complex one, involving, probably, 1,000,000 subscribers, progress had been made. Agreement has now been reached with three of the leading telephone manufacturing companies on the subject of patents, and orders are about to be placed for two large automatic telephone exchanges for Central London. It is hoped that within the next three years complete equipment for about 85,000 London lines will be installed.

ACCORDING to a contemporary, at the last council meeting of the Electrical Contractors' Association (Inc.), the following resolution was passed:—"That it is, in the opinion of this Association, a dangerous practice to install the two sides of a 3-wire direct-current system in one room in a private house or office where portable apparatus is used, and that for the protection of the public the practice should be discontinued. This Association is anxious to do all that is possible to develop the use of electricity for domestic purposes and to make it safe for the public, and submits for consideration that the balancing of one house or flat against another will give a far more effective balance than the manner now adopted by some supply authorities."

THE reports on the gas provided during the last quarter by the companies of the home counties, which have just been issued by the Gas Referees, show that in no case were the regulations infringed, while in several cases the quality of the gas was remarkably close to the declared value. In this respect the Gas Light and Coke Company shows up conspicuously, the average calorific value of the gas being only 0.28 per cent. above the statutory requirement. The South Metropolitan Company comes next, with an excess of 0.93 per cent., and is closely followed by the Wandsworth Company with 0.98 per cent. The Brentford, Commercial and South Suburban companies exceeded the required averages by 1.80, 2.30 and 3.85 per cent. respectively.

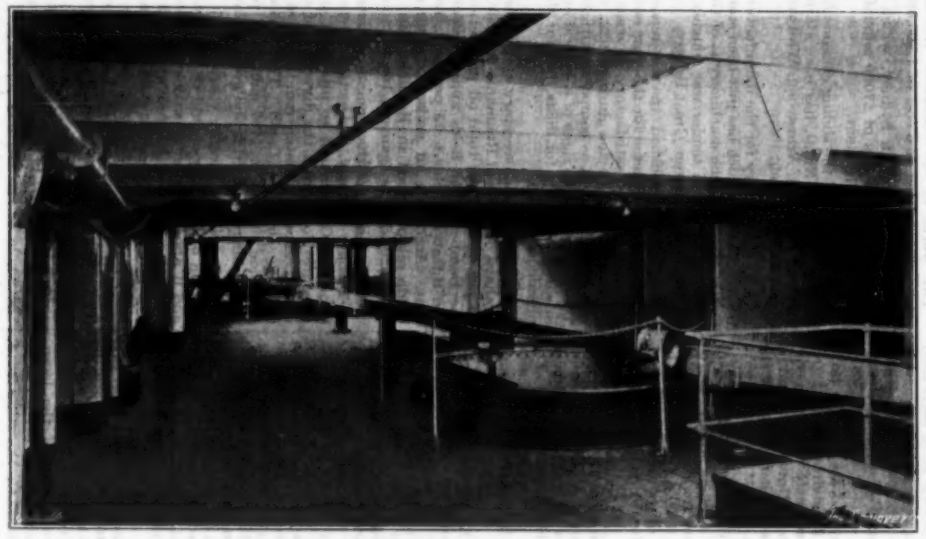
REPORTS from State mine inspectors to the Federal Bureau of Mines show that 1971 men were killed in and about the coal mines of the United States during the calendar year 1922. The outstanding features of the year's record were the heavy loss of life from explosions of gas and coal dust, and a five months' suspension of work by the miners, from April 1st to the latter part of August, which completely stopped the mining of anthracite coal and reduced the output of bituminous coal to about half the usual quantity. Notwithstanding the "major" explosions of gas and dust, the number of fatal accidents in coal mines was less than in any year since 1903, when 1926 men were killed. The 1971 fatal accidents during 1922 represent an actual reduction of 16 in the number of men killed, as compared with the revised record for the year 1921, which shows 1987 lives lost.

THE NEW CABLE SHIP FARADAY

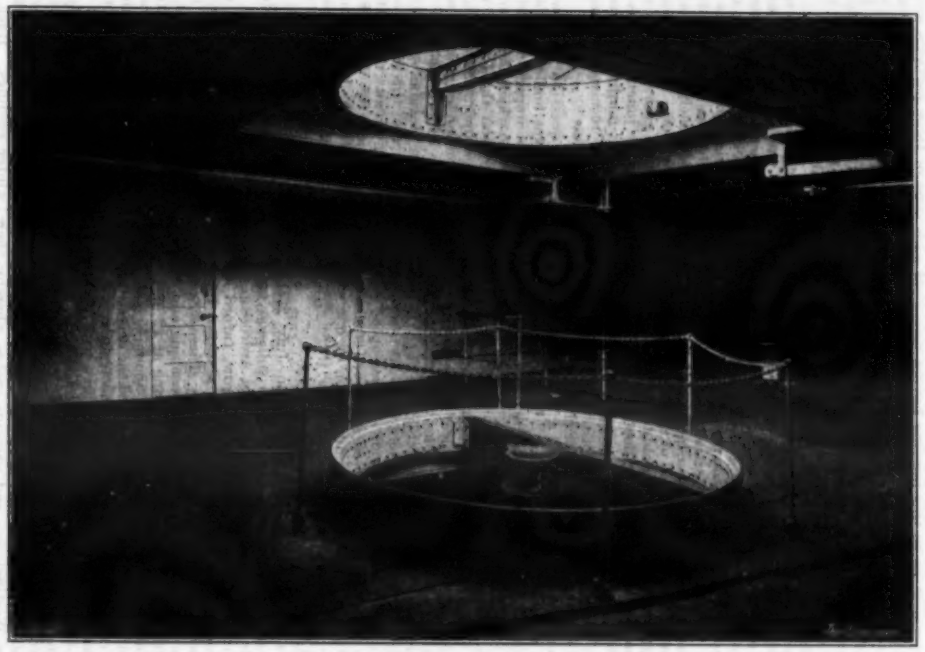
PALMER'S SHIPBUILDING AND IRON COMPANY, LIMITED, JARROW, ENGINEERS AND BUILDERS

(*For description see page* 106)

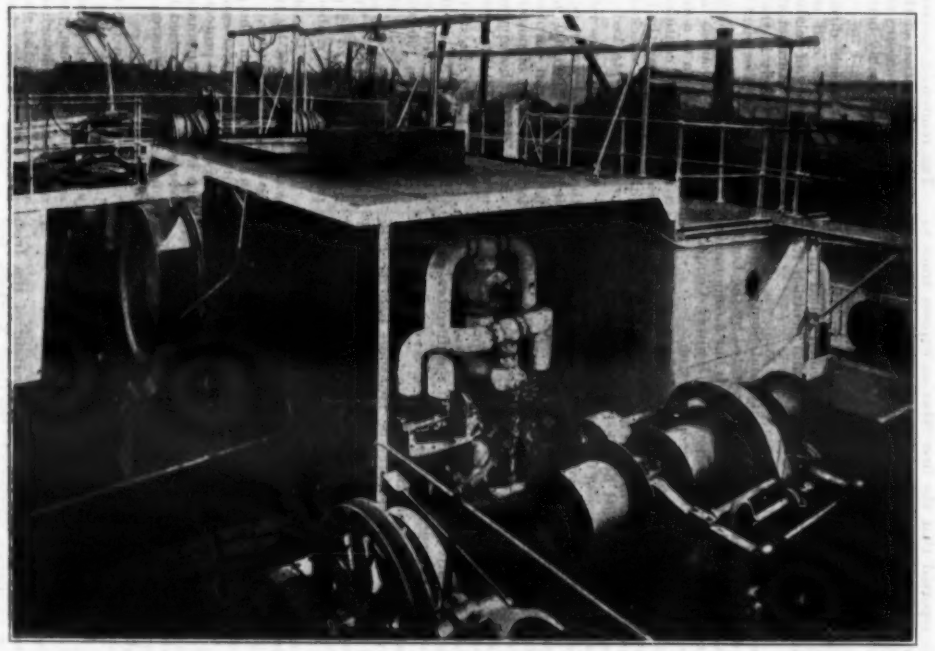
STERN CABLE SHEAVES WITH DYNAMOMETER AND JOCKEY GEAR



CABLE TROUGHING AND GUIDES ON SHELTER DECK



CABLE TANK HATCHES AND CABLE GUIDE



VIEW AFT SHOWING PAYING-OUT MACHINERY

THE MASS PRODUCTION OF OMNIBUS BODIES

SHORT BROTHERS, LIMITED, ROCHESTER, ENGINEERS

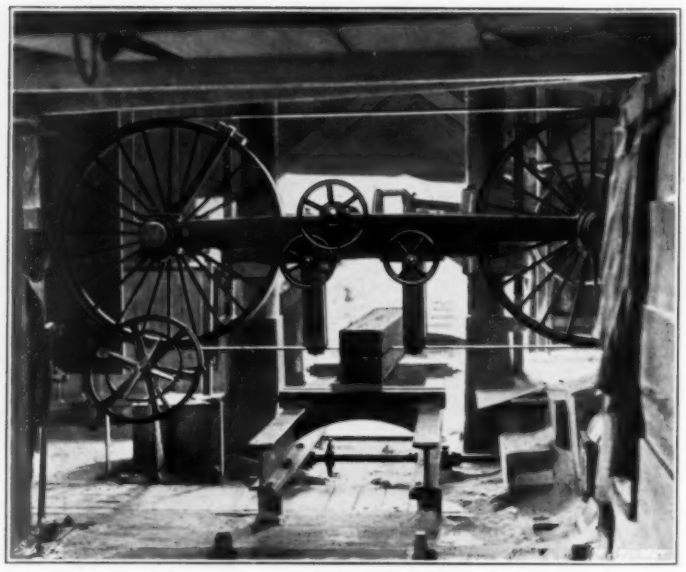


Fig. 1—BAND SAW IN TIMBER YARD

Fig. 2—THE LARGE SAW MILL

Fig. 3—ASSEMBLING ROOFS IN JIGS

Fig. 4—ASSEMBLING SIDES AND ENDS

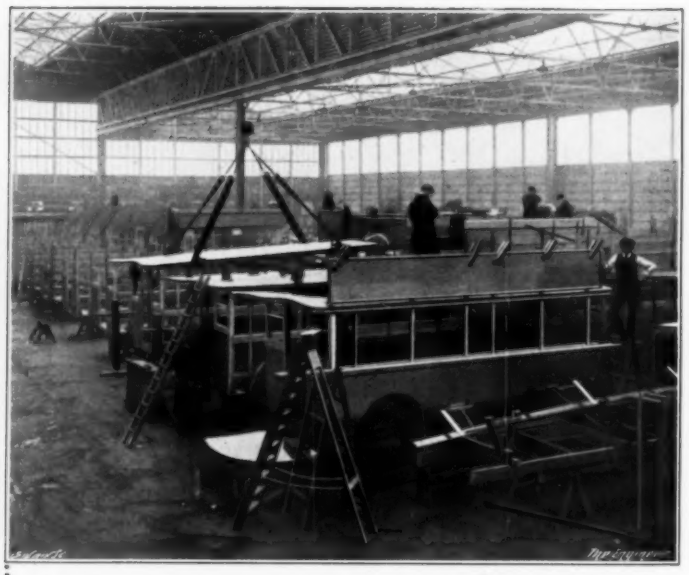


Fig. 5—BUILDING UP BODIES WITH THE CRANE

Fig. 6—COMPLETE BODY GOING TO PAINT SHOP

THE MASS PRODUCTION OF OMNIBUS BODIES

SHORT BROTHERS, LIMITED, ROCHESTER, ENGINEERS

Fig. 7—THE OMNIBUS PAINT SHOP

Fig. 8—THE CAR PAINT SHOP

Fig. 9—BODIES IN COURSE OF ERECTION

Fig. 10—A LARGE GROUP OF BODIES

Fig. 11—MACHINE SHOP

Fig. 12—MACHINE SHOP

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THE ENGINEER.

JULY 27, 1923.

Corrosion in Sea Water.

IT will, we suspect, surprise many of our readers to learn that the Institution of Civil Engineers, which is reputed to be a very wealthy body, finds it necessary to appeal for funds to carry on the research into the "Deterioration of Structures Exposed to Sea Action," which was begun several years ago. Yet that such is the fact is shown by the letter, reprinted, almost in full, upon another page, which the Institution has recently directed to various dock and harbour authorities. In 1916 or thereabouts, a special committee which was appointed to carry out the investigations applied to the Department of Scientific and Industrial Research for financial help, and received up to March last, from that source alone, nearly eight thousand five hundred pounds. The work, as shown in a memorandum which we also publish, is not nearly finished, but the Department of Scientific and Industrial Research refuses to provide any more money unless its standing rule that an equal amount is subscribed by the industries interested is also forthcoming. The Committee of the Institution estimates that for the next five years a sum of approximately £1250 per annum will be required to carry on the research, and it is, therefore, appealing for annual grants amounting to six or seven hundred pounds. The amount is a trifling one in comparison with the importance of the investigations upon which the Institution is engaged, and we shall be surprised indeed if it is not subscribed many times over. None of the smaller owners of sea structures are being approached. The appeal is addressed to the principal dock and harbour authorities in the United Kingdom—presumably Ireland is being invited to subscribe—in the Colonies and in India, and the principal dock-owning railway companies are also being approached. Putting the number of these "authorities" at the absurdly small figure of twenty-five, an annual subscription of twenty-five pounds each would meet the requirements of the Institution comfortably. We cannot believe that they will hesitate to make so small a contribution towards an investigation which, should it prove successful, must save them inestimable funds, and which, even in the least profitable circumstances, must provide knowledge of far greater material value than the sums sought for. Already the investigation into the deterioration of timber in marine structures has produced important results, and it is reasonable to hope that further research and experimentations will lead to very important conclusions.

With regard to corrosion, we confess ourselves a little less hopeful, but recognising as we do that of all industrial researches there is not a single one, nay, not a group of many, that approaches in potential value the solution of the problem of the rusting of iron and steel, we support the plea of the Institution with all the energy at our command. It has been estimated by Sir Robert Hadfield that the annual world loss of iron and steel through corrosion amounts to no less than twenty million tons, but it is almost impossible to estimate what the world expends year by year in the steps it takes to *prevent* corrosion. All we know is that between the actual loss and the means taken to retard that loss a colossal expenditure of labour and material is called for. So vast is the sum that any conceivable expenditure upon research work is small, insignificantly small, in proportion to it. Hence we say that even though the probabilities of finding a general solution may be remote the cost is so small, so trifling, that it is a thousand times worth making on the "sporting chance" that something important may be learnt. Corrosion is an extraordinarily baffling problem, and it is only by persistent endeavour, in every direction, that a solution is likely to be found. The first business is to acquire facts, facts, and more facts, What Charles Darwin did before he ventured upon his great generalisation we must do. We must observe all sorts of iron and steels and bronzes under all sorts of conditions, and faithfully record the results. Experience has shown, over and over again, that general deductions are still premature. Corrosion is, or appears to be, a very variable phenomenon, and some trifling modifications of conditions may produce diverse results. Small scale, laboratory, and accelerated tests are conducted under abnormal circumstances, and do not necessarily reflect or foreshadow the results in practical conditions. For long we held that large scale tests under conditions as similar as possible to those which iron and steel must meet in industrial employment would give more definite, more trustworthy answers. Alas, our own efforts with plates one foot square were not profitable, they were full of contradictions and did little to solve the problem. The Institution is pursuing somewhat the same course as we did, and it may find the same trouble in reaching definite conclusions that we did. But it has at its command resources which we lacked, and it is conducting its experiments on a larger scale than we could attempt. We are justified in hoping—even against hope—that it may achieve something, that it may, at least, find out something about corrosion under the special conditions to which its efforts are limited—exposure to sea water. But even if the committee should, after all, find no justification for making generalisations, it will have performed valuable work in the acquisition of statistics, from which sooner or later we may be able to construct a complete philosophy of corrosion in sea water, and which, in any event, must provide us with specialised facts for use in specialised circumstances.

So small is the individual contribution for which the Institution asks that we find it difficult to believe that any support of its plea is necessary. Yet men, and still more companies, may overlook such things, and we may at any rate perform this small duty to a great research of calling attention to it, and of urging all those who are in authority over sea-works to direct that such financial assistance shall be given to the Institution as will enable it to pursue its investigations for the five years that it deems to be necessary to complete its work, or for so much longer as may be required. We lay stress upon the last words. The solution of the problem of corrosion in sea water may not be found in five years. But it is imperative that it shall be found, and there could be no more valuable grant than one that would continue indefinitely until the solution to this baffling problem had been achieved.

The Dangers of Sulphuretted Hydrogen.

THE recent inquest on three men who were suffocated by fumes in a pumping shaft and sump at a chemical waste heap near Bury, Lancashire, on July 11th, invites a few words of comment, because the toxicity of sulphuretted hydrogen, which was shown to be responsible for this occurrence, does not seem to be sufficiently recognised. Though not the primary cause, the heat and general climatic conditions on the fateful day, greatly accelerated the potential dangers which those in charge of the operations recognised to be existent, though it is clear from the evidence that the extent of the effects of a high temperature had not been foreseen. The work in hand was being undertaken in order to divert drainage issuing from the waste heap, so that it could not enter the sewers, and the

fact that the heap consisted of alkali waste which contains calcium sulphide as its main constituent was well known. Such waste heaps many years old are still a prominent feature of the landscape in some of our manufacturing centres, and after this accident at Bury it is to be hoped that if operations of a similar nature are undertaken, they will be superintended, or at any rate conducted, under the instructions of a qualified technical chemist or medical man. Without wishing to say a word against work of this sort being controlled by civil engineers and contractors, we must express the view that the responsibility for taking precautionary measures should be in the hands of someone especially qualified; someone, in short, who would be in a position to know what special dangers might be apprehended under particular climatic conditions.

Judging by the evidence in this case, evidence which we admit showed that the engineer in charge was fully cognisant of danger, for gas had always been present in a minor degree, it does not appear that the chemist appeared upon the scene until the accident had occurred and an inquest was in view. The evidence given by him that the heap contained cavities filled with sulphuretted hydrogen gas was important, showing that the danger was greater than that associated with solid sulphide bodies where the carbonic acid of the atmosphere brings about decomposition with some evolution of sulphuretted hydrogen, but whether the presence of this gas was known to those responsible for the operation, we cannot say. It appears that although the work of making a puddle trench round the waste heap was commenced last November, the men had up to the time of the accident experienced no ill effects beyond sore eyes and fingers. On June 28th, however, at the coming of the heat wave, the gas in the sump hole was reported to the engineer as being rather worse than before. He, therefore, told the foreman that he was not to allow any man to go down unless a life-line was attached to him. The engineer added in his evidence that he did not suspect any danger, but he thought it better to take precautions. Without commenting further upon this evidence in its special connection, we may say that there seem to be many people, including chemists and engineers with the general public, who do not sufficiently recognise the toxicity of sulphuretted hydrogen, or the fact that while a certain volume of the gas in the air may be innocuous under certain conditions, it may be the reverse when those conditions alter. A compilation, did it exist, of the fatal accidents which have been correctly attributed to sulphuretted hydrogen would not, perhaps, be very lengthy, but it would be illuminating and instructive. It is only about a year ago that a workman was fatally gassed when opening a drum of sodium sulphide—a chemical which is now found in commerce in much larger quantities than was the case a decade ago. If we remember rightly, much surprise was expressed at the fatality when an inquiry took place in due course; but we are assured by those in a position to know, that the evolution of gas is by no means rare, especially where drums have been damaged in transit. Sulphides in solution form effluents which are always troublesome, and frequently a source of danger, because if they come in contact with another effluent containing acid, sulphuretted hydrogen is evolved. Hence, they are anathema to sewer authorities, who usually take all lawful steps to secure their exclusion. It was such action by the town authorities at Bury that led to the work being undertaken at the waste heap to which we have referred, and as similar action may be in contemplation elsewhere, it is of importance that the lesson learnt should be widely known.

Many people living at a distance from Bradford have read of the troubles caused to residents of certain houses in that neighbourhood by noxious effluvia, said to be due to the fact that the site of these houses was an old chemical waste tip. This may or may not be the case—we only go by what has appeared in the Press—but there is nothing inherently improbable about it. No doubt, there are numerous waste heaps up and down the country where chemical works formerly existed, and, as occurs in worked-out clay ironstone mining centres, such heaps may in certain instances have been levelled and the land brought back into cultivation or adapted for some useful purpose. It is not a fantastic supposition that chemical changes unsuspected at the time of levelling the heaps may develop in later years in some of these cases, and lead to troubles described as mysterious happenings. The effect of pressure upon many chemicals is a comparatively unknown factor which comes into prominence when large heaps are formed. During the war the problem of how best to dispose of various waste chemicals being produced in unprecedented bulk was always arising. In some cases they were dumped into the sea, but where this means of disposal was not available, consulting chemists often had the onus of deciding whether it was desirable to allow artificial mountain ranges which contained small quantities of explosive to be formed contiguous to inhabited areas, and where they might reasonably be expected to form the playgrounds of children. Of course, all the unprecedentedly large heaps of chemicals formed in the war period—such as those of pitch and burnt pyrites—were not waste material, but substances awaiting a market. Such heaps have now largely been disposed of, and therefore no questions arise as to their future. With regard, however, to others, both old and recent, it would seem advisable that before engineers or contractors get to work on them the possibilities of danger to life should be thoroughly investigated by a competent chemist.

The Design of Earth Dams.

THE earth dam is a type of engineering structure of very early origin and of very extensive use in many countries, but it is within comparatively recent times that its design has been made the subject of scientific investigation. In a paper on the design of earth dams, recently read before the American Society of Civil Engineers, Mr. Joel D. Justin discussed a series of conditions which must be met to ensure safe and permanent construction of a structure of this type.

Although the overturning of an earth dam is a practical impossibility, the factor of displacement by sliding must be considered, but if the essential conditions are, in fact, covered in the design, the dam is pretty sure to be safe against sliding. The materials used in the so-called "earth" dam or embankment, include soil, clay, gravel, sand of varying degrees of fineness, and loose rock, all of which may be used with safety. In all such structures there is what is known as the line of saturation, or the highest line of flow of water through the dam and subsoil. The hydraulic gradient is defined as a line joining the highest points to which water would rise if a series of vertical pipes was built into the cross section of the dam. This line is generally, but not necessarily, coincident with the line of saturation.

The conditions suggested by Mr. Justin as essential are as follows:—

CONDITION NO. 1: OVERFLOW.

An earth dam should be designed with ample waste weir or spillway capacity to preclude any danger of flood water overtopping the dam, as it would practically mean certain failure. In the failures of earth dams a frequent cause has been the provision of insufficient spillway capacity, and Mr. Justin states that many dams now in use have spillways that are unable to pass floods which are certain to come sooner or later. Methods are available for determining the greatest possible flood, and the spillway should be designed to pass that flood with a fair factor of safety.

CONDITION NO. 2: LINE OF SATURATION.

An earth dam should be so designed that the line of saturation is well within the downstream toe. Some of the factors affecting the position and slope of this line are as follows:—(*a*) Porosity and size of particles of the material in the dam and its foundation; (*b*) distribution of particles of various sizes throughout the cross section; (*c*) depth of soil below base of dam and form of surface of bed rock; (*d*) ground water flow and its depth below the original surface; (*e*) nature and depth of soil downstream from the dam; (*f*) the existence and position of a core wall, puddle wall, or apron within the dam; (*g*) the provision of drains for collecting seepage in the downstream part of the dam. This general subject Mr. Justin discusses at considerable length, together with the closely related subject of the movement of underground waters, for which numerous formulas are given to meet varying conditions.

CONDITION NO. 3: SLOPES.

The upstream and downstream slopes of an earth dam must be such that for the materials used in construction the slopes will be stable under all conditions. The slope of the upstream face should be determined by the under-water angle of repose of the material, which usually will be flatter than the angle for the same material in air, but the slope should be rather flatter than that which is indicated as safe by the experiments. For the portion under water the slope should be not more than half that at which the same material will stand in air. Although slopes as steep as 1 vertical in 1½ horizontal have been used for the upstream face, Mr. Justin considers that in general it should not be steeper than 1 in 2. For the downstream face the slope will generally be determined by condition No. 2 in keeping the line of saturation within the downstream toe. However, the slope, in any case, should be flatter than the angle of repose of the material forming that part of the dam.

In earth dams more than 30ft. high there should be bermes of 6ft. to 20ft. in width on the downstream side, these bermes being about 30ft. apart vertically in high dams. As their function is to minimise the erosion from rain, they should have a transverse slope inward to a gutter along the toe of the slope above. Bermes are formed sometimes on the upstream side, and should always be provided at the bottom of any stone or concrete revetment which may be used as a protection against wave action. If the reservoir is likely to be emptied frequently, this lining should extend to the toe of the slope, but otherwise it may be stopped at a berme at the approximate level to which the water will normally be lowered.

Concrete lining should not be relied on as watertight, or used with the idea of preventing water from entering the embankment, according to Mr. Justin. He considers a reinforced monolithic lining as of doubtful value, and prefers blocks not larger than 6ft. square, with a thickness in inches equal to the length of the side in feet, or 6in. for a 6ft. by 6ft. block. These blocks or slabs should be poured alternately and separated by layers of tar-paper, so that they may adjust themselves to any settlement in the embankment. The bottom row of blocks should rest against a concrete curb not less than 18in. deep in the berme. Smaller pre-cast concrete slabs are sometimes used.

Whether stone or concrete slope paving is to be used as a protection against wave action must depend on the relative cost. With a slope of 1 in 3, heavy earth containing from 5 to 10 per cent. of stones and gravel will ordinarily withstand wave action without lining. But lighter material would require such flat slopes that lining is cheaper. Mr. Justin refers to a case where sand was given a slope of 1 in 4, and lining was considered unnecessary; but in a few days the the wave action had worn down the slope to 1 in 10, demonstrating that protection was needed. Log booms or floating fenders are sometimes used to break the waves before they strike the face of the dam.

For the top and downstream slope, a facing of 8in. to 10in. of rich soil is recommended, treated with 600 lb. of fertiliser per acre. The surface should be raked and seeded to grass. The matrimony vine (*Lycium vulgare*) has also been used to form a surface protection. With it the top soil becomes a tangle of roots. Slope lining on the upstream face may be made unnecessary if the corewall is so placed that it intersects the slope at about the elevation of normal high water, assuming that the reservoir will never be drawn down much below that level. This arrangement has been used in a number of dams for water power plants in the Western States.

CONDITION NO. 4: LEAKAGE ALONG PIPES.

It is important that there must be no opportunity for the free passage of water through the dam—by defined seams or openings—in quantities greater than would be indicated by the term "seepage." Such openings may be caused in the following ways:—

(*a*) By settlement of earth along pipes or conduits through the dam or along the smooth surfaces of concrete walls or abutments.
(*b*) By burrowing animals.
(*c*) By coarse material so placed or settled as to form a blind drain through the dam.
(*d*) By failure properly to bond and compact the layers of earth so as to form a homogeneous mass.
(*e*) By a layer of pervious material forming a seam.
(*f*) By failure to bond the bottom layers with the material of the foundation.

In Mr. Justin's opinion pipes and conduits should not be laid through an earth dam unless they rest on the original foundation material or on a solid wall—provided with cut-offs—founded on this same material and extending the full width of the dam. Pipes laid in trenches in the foundation should have not less than three transverse collars of concrete cut-off walls extending into lateral trenches and above the top of the pipe trench. Where wasteway abutments, power-house walls or other concrete walls extend from the upstream to the downstream face of the dam, the surface should be broken by at least two cut-off wings or buttresses projecting well into the dam. Protection against burrowing animals is afforded by a concrete or stone revetment or by a core wall extending above high-water level.

Careless placing of material may result in forming a blind drain through the dam, but this can be avoided by inspection to ensure that no continuous lines of coarse material are formed. In a dam built by the hydraulic sluicing method and with a narrow central pool there is a tendency for tongues of coarse material to build up across the pond. This has been prevented in some cases by breaking up such tongues with ploughs. If successive layers of material are not properly compacted and bonded as they are laid there is liability to cause horizontal seams. This is specially the case where the top surface has become dry and hard and smooth, but such surfaces should

be scarified and sprinkled before the next layer is deposited. If the character of the material in the dam varies considerably there is liability of forming a layer of relatively pervious material. This condition may cause considerable trouble to the engineer and expense to the contractor in getting the more pervious material deposited on the downstream side and kept away from the upstream side.

It is of the utmost importance to bond the lower layers of the dam with the foundation material in order to prevent the formation of seams or planes of separation along which water might find its way. For this reason stumps, roots and top soil containing more than 6 per cent. of vegetable matter should be removed, since decay of vegetation will leave voids. When the surface is thus cleared it is well ploughed and scarified, and if no core wall is to be built it is desirable to excavate a trench on or upstream from the centre line of the dam, to be filled with suitable material well compacted. When a core wall is to be built to prevent the free passage of water through the dam, it should be considered only as an additional safeguard, and all the other precautions should be observed strictly.

CONDITION NO. 5: LEAKAGE THROUGH DAM.

It is essential that any water which passes through or under the dam must have so slight a velocity that it is incapable of moving or dislodging any of the material of the dam at the point where the water rises to the surface beyond the toe of the dam. Even if the dam itself should be thoroughly impermeable it might be placed on a foundation of material sufficiently permeable to allow water to pass with such velocity as to move the particles of this foundation material and thus cause piping or a blow-out. The theoretical scouring velocity of water passing through a dam or its foundation may be found by computing the pressure due to jet action necessary to overcome the effective weight—or weight in water—of the various sized particles. But the permissible velocity in most cases should be insufficient to move even fine silt, since with this material dislodged larger material will fall into the cavities and be moved. To prevent piping in the dam itself, for any given height and material the thickness along any horizontal plane must be sufficient so to reduce the velocity of water passing through it that the finest particles will not be moved. If the material of the foundation is so permeable that the thickness of dam at the base to prevent piping would be impracticable, recourse may be had to a puddle trench, a core wall or a line of sheet piling driven to a less permeable stratum.

CONDITION NO. 6: WAVE ACTION.

The freeboard or height from top of waste weir to top of dam must be sufficient to prevent any danger of waves overtopping the dam and causing erosion. Mr. Justin states that many earth dams have failed from this cause, and in his opinion the freeboard seems to be determined by custom. It varies from 3ft. to 5ft. in small dams, 6ft. to 10ft. in ordinary dams, and 10ft. to even 30ft. in large and important earth dams. The top width of dam is a factor in protection against erosion of the downstream slope by overtopping waves. This width—which should never be less than 10ft.—is taken sometimes as one-fifth of the height plus 5ft., or as one-fourth of the height. Other factors are:—(1) The depth to which frost will penetrate; (2) the height of waves along the upstream slope; (3) the height above waste weir to which the water level will be raised by the greatest floods predicted for a long term of years. In any one case, the minimum freeboard would be the sum of these three heights.

In relation to wave action and width of dam, as mentioned under conditions three and six, the features may be noted which are not included by Mr. Justin. In some of the long river embankments or *levées* which protect low lands from flooding, these have been utilised as railway embankments. This is favourable to good results owing to the greater top width and to the constant supervision.

The second case is that of a long dam for an irrigation reservoir with a reach of about 9 miles of water above the dam; heavy wave action was expected, but no rock was available for revetment except at great expense for transportation, and a concrete lining also would have been very expensive. The dam had an upstream slope of 1 on 3 and a top width of 20ft. As an experimental expedient a heavy facing of coarse gravel—from small pebbles and sand to large cobble stones—was placed by dumping from tip wagons, increasing the top width to 50ft. or 60ft. and giving a slope of 1 on 1½. The slope became irregular, but the average increased gradually during eight years until it became practically stable at 1 in 3¾. It is estimated that this could be renewed twice—giving a period of at least thirty years—at less cost than the paving of the slope with stone or concrete at the time of construction.

HYDRAULIC-FILL DAMS.

Hydraulic-fill dams made by sluicing represent a special form of construction, but must be governed by the fundamental conditions above described. Mr. Justin points out that during and immediately after construction, while consolidation and drainage are taking place, dams of this type may be subject to internal stresses due to the outward pressure of a semi-liquid or plastic core. For this reason it is general practice to employ a wider section or heavier toe fills of rock than would otherwise be required. It has been suggested also by Mr. Allen Hazen, a noted hydraulic consulting engineer, that these internal stresses may be avoided by limiting the size of particles of material used in the core or central portion of the dam.

CONCLUSIONS.

In his conclusion, Mr. Justin states that in order for any earth dam to be safe it must meet successfully each and all of the six conditions herein discussed—except in a few special cases in which particular methods for safety are adopted. An earth dam must also fulfil the preliminary requirement for safety against sliding; but usually this will be satisfied if the other requirements are met. Finally, he expresses his opinion as follows:—

"It may be stated confidently that any earth dam which meets these requirements, after the construction stage has been passed, will be safe, and that any earth dam that fails to meet each and all of them is likely to be unsafe. It should be remembered also that the best of designs may be ruined and failure insured by inefficient construction undertaken without proper engineering supervision."

Obituary.

REGINALD LAURENCE.

THE death is announced as having taken place in a nursing home in London on the 22nd inst., of Mr. Reginald Laurence, who was, for thirty-five years, the chairman of Laurence, Scott and Co., Limited, of Norwich. Mr. Laurence, who was the seventh son of the late Mr. Sidney Laurence, of Clapham Park, was born on February 17th, 1857. He was educated at Harrow and Dublin, and was subsequently, for some time, in the Cockerill works at Seraing. He joined the Norwich firm on its formation in 1888.

Unemployment.

SIR ALLAN SMITH, chairman, and Mr. P. Hannon, secretary, of the Industrial Group of the House of Commons, have addressed a letter to the Prime Minister, in which they say that at a meeting of the Industrial Group at the House of Commons on Thursday, July 19th, it was unanimously resolved to convey to him an expression of the grave apprehension with which the Group regards the present volume of unemployment and the prospects of the coming winter.

They go on to say that it appears inevitable that, unless very drastic measures are taken immediately a fourth winter of unemployment, with not less than 1¼ million unemployed, must occur. The results of this on the *morale* of the British worker will be disastrous, and his efficiency must be irretrievably damaged. There are, moreover, 100,000 ex-Service trainees for whom the promised employment cannot be found. Large numbers of skilled workmen are emigrating to America, and any large revival of trade will be accompanied by a shortage of skilled labour. They add that the disruptive force of unemployment on the trades unions, which are a safeguard of industrial peace, cannot be viewed without apprehension. Between January and March, 1923, the balance funds of the Amalgamated Engineering Union decreased from £271,000 to £220,000, and between December 1st, 1920, and July 1st, 1923, the membership of the union decreased from 460,000 to 290,000. In the opinion of the executive of the union, the present rate of unemployment, if maintained, will involve within twelve months the complete dispersal of the funds and membership.

It would, therefore, appear desirable, they say, that the Government should address itself to a particular consideration of the possibilities of developing the resources of this country. The Industrial Group has considered, and is considering, the whole problem in this light, and has arrived at certain conclusions. It appears to the Group that there are certain definite desiderata in any effective policy. In the first place, the problem, by its very nature demands for its solution a policy of employment rather than an unemployment policy. If a definite policy of productive employment is formulated unemployment will look after itself.

For this reason as much actual work as possible, and further definite promises of work, which have a great psychological effect, should be given before Christmas. To maintain a high standard of efficiency, it is imperative that men should be employed, as far as possible, in their own trades, and it is further desirable that they should be employed in their own neighbourhoods.

The Group proposes that the electrification of railways should be pressed forward, and mentions particularly:—(*i*) The extension of the electrification of the London and South-Western Railway; (*ii*) the completion of the suburban electrification of the London, Brighton and South Coast Railway and the electrification of the main line to Brighton; (*iii.*) the suburban electrification of the Great Eastern Railway; (*iv.*) the electrification of the main line—York to Newcastle; (*v.*) the electrification of the Midland Railway to Tilbury and Southend.

The adoption of the above schemes would involve, with the necessary power stations, an expenditure of forty to fifty million pounds.

Other possible schemes include electrification round Glasgow, of the suburban lines round Manchester, and of mineral lines in South Wales.

The increasing problem of bringing city workers into the Metropolis and relieving congestion during "rush hours" makes further extension of tube railways necessary. An instance is afforded by the demand for a tube railway beyond the Stratford "bottle-neck" to Ilford. Furthermore, much needed work on the reconditioning of railways might be put in hand at once. The passage of the Railways' (Authorisation of Works) Bill would facilitate this.

The Industrial Group considers also that the time has come when effect should be given to the recommendations of the Royal Commission on Canals and Inland Waterways, and particularly to the majority report of the Chamberlain Committee presented in 1921, and suggests that the following schemes should be considered:—Lower Thames Tunnel, Grimsby Floating Dock, Port of London Authority Dock Extension scheme. Approved municipal schemes which are definitely revenue-producing should also be authorised.

In conclusion, the Group points out that, even if the adoption of the policy indicated necessitated the payment by the Government of interest for several years on the capital involved, the sum would be very small in comparison with the unemployment dole and relief granted by the guardians, while failure to act will entail irreparable harm to the *morale* of the workers and a grave menace to the social and economic stability of the country.

THE YARROW CONVALESCENT HOME.

SATURDAY last, the 21st inst., was Founder's Day at the Yarrow Convalescent Home at Broadstairs. The home was established and endowed by Sir Alfred Yarrow in 1895, and its purpose is to benefit the children of professional and well-educated parents, whose means may not be sufficient to give them, without assistance, that change of scene and air which is often so necessary for recovery after illness.

About one hundred children are now in residence, and a large party travelled down from London to spend the day with them. The guests were received by Sir Alfred and Lady Yarrow, and after luncheon, the health of the founder was proposed by Dr. W. B. Worthington, Past-president of the Institution of Civil Engineers. In his reply Sir Alfred reviewed the objects and the work of the home, and paid warm tribute to the work of the staff and helpers. Quoting Sir Crichton-Browne, he said that the period of convalescence was often as critical as illness itself, and such a home undoubtedly spread relief and happiness and might be the means of rescuing many young people from lifelong disability. During the afternoon sports were held on the lawn, and the band of the Royal Marines gave a programme of music.

Particulars of the work of the Yarrow Home will gladly be furnished by the secretary, at the London office, 116, Victoria-street, S.W. 1.

THE MOTOR FUEL "DISCOL."

SPEAKING at the annual meeting of the Distillers Company in Edinburgh last week, Mr. W. D. Graham Menzies, chairman of the company, referred to the success of alcohol mixtures as fuel for racing cars and motor cycles, and stated that there was an increasing demand for this type of fuel both within the United Kingdom and also from the Continent. Since the motor fuel "Discol" was produced at Hammersmith Distillery, the company had established a mixing department at Bankhall Distillery in Liverpool, and within the last ten days a Scottish depôt had been opened at Parkston Station, Glasgow. It is not the intention of the company, we understand, to supply this fuel in the usual two-gallon tins, but it may be supplied to commercial and private users who can take 50 gallons at one time. The company, Mr. Menzies said, had never made any claim to be able to compete with the oil companies. Its real object was to run alongside them, so that if a shortage of petrol should ever take place, the country would have at least a limited supply of alternative home-produced fuel to fall back upon.

BOOKS RECEIVED.

Metals and Metallic Compounds: Vol. III., The Transition Elements. By Ulick R. Evans. London: Edward Arnold and Co., 41–43, Maddox-street, W. 1. Price 14s. net.

Metals and Metallic Compounds: Vol. IV., Metals of the "B" Groups. By Ulick R. Evans. London: Edward Arnold and Co., 41–43, Maddox-street, W. 1. Price 18s. net.

Jordan's Tabulated Weights of Iron and Steel Sections. Edited by Lloyd's Register of Shipping. London: E. and F. N. Spon, Limited, 57, Haymarket, S.W. 1. Price 15s. net.

The Society of Engineers—Journal and Transactions. Vol. XIV. No. 2, April–June, 1923. Published by the Society, 17, Victoria-street, Westminster, S.W. 1. Price 5s. post free.

Engineering Non-Ferrous Metals and Alloys. By Leslie Aitchison and William R. Barclay. London: Henry Frowde and Hodder and Stoughton, the Lancet Building, 1 and 2, Bedford-street, W.C. 2. Price 21s. net.

A Fair Wage: Being Reflections on the Minimum Wage and Some Economic Problems of To-day. By Edward Batten. London: Sir Isaac Pitman and Sons, Limited, Parker-street, Kingsway, W.C. 2. Price 2s. 6d. net.

THE London and North-Eastern Railway Company now advertises its trains as being hauled by "the largest and most powerful locomotives in the country."

Building Omnibus Bodies.

THE construction of wooden bodies for mounting on the chassis of motor omnibuses appears, on first thought, to be merely a coachwork job and to have little connection with mechanical engineering, but a visit which we made recently to the works of Short Bros., at Rochester, quickly convinced us that if this class of work is to be carried out on any extensive scale, it essentially needs the guidance and supervision of an engineer.

The works in question—of which we give an aerial view on this page and which are the subject of our Supplement this week—were put up during the war for the construction of seaplanes, and at the time the Armistice was signed, considerable extensions to the factory had just been completed. The newer shops, which can be seen on the right of the illustration, necessitated a large amount of excavation, as the site is the steeply rising bank of the river Medway, a short distance above Rochester Bridge. The spoil from these operations went to form the large dump of chalk seen beyond the sheds.

Towards the end of hostilities the firm was employing some 1600 hands, and in view of the cessation in the demand for flying machines, the directors naturally looked around to find some other sphere in which their extensive plant could be employed. The re-equipment of steamships suggested an opportunity, and a large number of ship's lifeboats were built, dinghies and other small craft were turned out in fair quantities, while some barges and steam tugs were built on the two slips, which are included in the establishment. A very fine tug was, by the way, being completed when we visited the yard. Various other classes of work, such as the making of light motor cars, electrical appliances and trackless cars were undertaken, but with the exception of the trackless cars, the demand does not appear to have justified any very great development.

Comparatively recently, however, the production of bodies for road vehicles has been taken up, and now there are very nearly as many hands at work in the shops as there were in the most busy days of the war. Some of the departments are, in fact, running continuously from Monday morning to Saturday afternoon.

The most important contract going through the shops just now is for the bodies of the new "One-step" omnibuses of the London General Company, and they are being turned out at the rate of from twenty-five to thirty a week, while it is hoped to increase even that output before long. Standard bodies are also made for Fiat, Citroën, Oakland, Renault and Salmson cars, on much the same principles as are adopted for the omnibus bodies, while special bodies are built for char-à-banc and other vehicles.

The standard bodies are all manufactured by jig processes, and comparatively little skilled labour is necessary. It is, in fact, all repetition and assembly work arranged according to a most carefully thought-out programme in which all the processes follow a very definite sequence. The men are not, however, paid on the piecework system, but on time rates. We noticed, nevertheless, that they work quite diligently, and this nice state of affairs is no doubt accounted for, to a large extent, by the enthusiasm of a fine band of foremen and also by a graphical system of time keeping. The works manager has a series of graphs prepared weekly, showing the man-hours expended on the production of various unit parts. It was very interesting to observe, on studying these charts, how, in spite of a certain amount of irregularity which could only be expected, the curves all have a steady downward tendency, while the irregularities in the graphs for the individual items are softened out into a fairly smooth curve for the complete product. These graphs naturally give the manager a ready means of discovering if the work is going on satisfactorily, and he can quickly decide where to make investigations if necessary.

TIMBER.

The principal raw material used in the works is, of course, wood, and it is almost exclusively ash, spruce and birch ply-wood. The ash is mostly home grown, and the company has a representative who travels about the country selecting trees suitable for conversion. It is, unfortunately, too often the practice of landowners to let their ash trees grow so big and old before they are felled that the wood loses its resiliency; but we noticed that the log pile at Rochester, one corner of which we illustrate, was composed of good young trees. The spruce timber comes by barge from the London docks, and is unloaded alongside by a 5-ton Smith crane.

At the end of the timber yard there are two saw mills. One is equipped with a Robinson vertical gang saw for cutting up the hardwood logs; while the other—see Fig. 1 of our Supplement—has a Ransome horizontal band saw, which is principally used for converting the spruce into planks. The second mill includes several other machines, including a vertical band saw, by the Calder Valley Engineering Company, which has the framework so arranged that the saw can be canted to any angle as the cut proceeds, and thus greatly facilitates the cutting of compound curves, such as those found in ship's timbers.

The roughly prepared timber is taken away from the saw mills on electric trucks to the drying kilns. These kilns are heated on the Sturtevant system, by steam generated in a vertical boiler fired with waste wood from the mills. The waste is collected by a system of pneumatic ducts, and is charged into the furnace by hand. Separate kilns are provided for the ash and spruce. It takes, we were told, about forty days to dry out ash timber 4in. thick. All the boards are cleated at the ends to prevent checking through the end grain drying more quickly than the sides.

In connection with this drying plant we noticed a rather unusual arrangement of smokestack which indicated one, at least, of the inconveniences of the place as a site for a factory. The chimney of the kiln boiler is just below a row of residential houses on the hillside, and when the wind is in certain quarters the smoke blows over the houses. So a long length, about 100 yards, of piping was laid along the top of the bank at the back of the kiln and connected with the chimney. At the far end, which reaches beyond the houses, there is a small fan. When the wind is in the troublesome quarter, this fan is started up and the smoke is taken clear of the houses, but otherwise the natural draught of the straight chimney is used.

The amount of scrap wood available is ample for running the kilns and doing some other heating work. Even then there is a fair amount for sale; but another, Galloway, boiler is now being put down with the object of utilising the scrap more fully and supplying steam to the paint shops, &c., which now have a separate isolated boiler.

When the timber is properly seasoned it is taken to the large saw mill, part of which is shown in Fig. 2. This shop is equipped with a number of band saws, vertical spindle cutters, morticing machines and planers—we noticed that a considerable proportion of the machines were by Sagars. All the shafting and belting is arranged below the floor, so that long pieces of timber can be handled without fear of fouling running belts. It is here that the woodwork is all prepared ready for assembly in the omnibus and car bodies, and the mill has to be kept running twenty-four hours a day to keep pace with the demands of the erecting shop.

REPETITION WOODWORK.

All the various members that go to make-up the framework of a body, whether it be for a motor car or an omnibus, are made exactly to a pattern, so that they are interchangeable, and may be made for stock. The principle is really very simple, although as many as fourteen operations may have to be made on one piece; but the result is a remarkable uniformity in product, and we were told that warping, after finishing, hardly ever spoils a piece.

Some of the framework members, such as the corner posts, have a decidedly complicated form, being bent in two planes and having fillets, recesses and mortices spaced at various distances along their length; but the procedure is the same with all of them. The piece is first roughed out with a hand saw, and one of the sides is left straight. This straight side is used for positioning the piece in an open topped box, the inside dimensions of which are such that they will just accommodate the rough piece. The top edges of the sides of the box, against which the lid would shut if it had a lid, are shaped to the contour of one of the sides of the finished member, and the rough timber projects beyond these edges. The box, with the rough piece of work in it, is then taken to a vertical spindle moulding machine. Surrounding the cutter spindle there are two circular brass guards, one above and the other below the cutter, against which the edges of the box are pressed by the operator as he feeds the job along in front of the spindle. The amount of material removed and the shape of the surface produced are thus exactly determined by the top edges of the box. Other boxes are used in a similar manner for shaping the other sides of the piece, the position of which in the box is then naturally determined by the already machined faces, and as many as ten boxes may be necessary before the member is finished. Some of the boxes are, however, used for more than one operation; such, for instance, as those for morticing.

The mortices are cut with chain cutters, while the piece is held in a box furnished with little metal bridges. The bridges have holes corresponding with the positions of the mortices, and through these holes the cutter is fed until it meets a stop for the depth. Screw holes, also, are drilled in jigs, so that nothing is left to the idiosyncrasies of the workmen, and even the little bit of rounding off at the end of a rail, which an ordinary joiner would habitually do with a paring chisel, is done by machine.

BIRD'S EYE VIEW OF SHORT BROS. WORKS ON THE MEDWAY AT ROCHESTER

During our tour of the mill we were given several examples of the speed of output attained by these methods, but without detailed drawings of the pieces made these quantities would mean very little to the average reader. The impression we gained was, however, that about eight times as much material was being turned out by unskilled labour as could be produced by a corresponding number of highly skilled joiners, while the scheme positively assured the matching of all pieces.

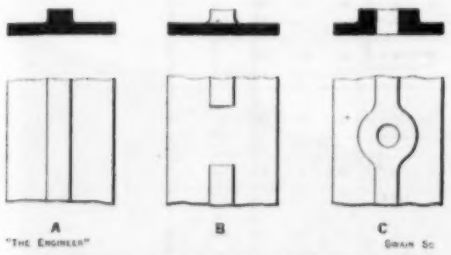
The various pieces are put in hand in the mill in batches so that the equipment may be used for a fair length of time without being changed, with a consequent loss of productive time. The batches are made up in quantities for not less than twenty-five omnibuses, but whenever possible they are ordered in fifties. Before we leave this department we may remark that the three-ply panelling is also prepared there, and that the screw holes are drilled in a jig provided with little metal bushes. Half a dozen or so panels are clamped together, with the jig on the top and put under a high-speed drill with a wide gap. A specially long twist drill is used, and we were rather struck with the fact that although it must meet a considerable amount of glue in going through the three-ply, the drill cleared the hole nicely even when it had been broken off and re-ground, until the flutes were much shorter than the depth of the hole. The holes are subsequently countersunk by pressing in a conical punch, as it has been found that a rose bit leaves a ragged edge in this material.

STEEL WORK.

There is, of course, a considerable amount of metal work in the construction of an omnibus body, but a large part of it is of a class familiar to engineers. Some more specialised parts were dealt with in our recent article describing the Chiswick depôt of the omnibus company, and Messrs. Short have naturally benefited by the experience gained there, so it is unnecessary to enlarge upon them here. We were, however, very forcibly impressed with the extent to which the acetylene blow-pipe was used in building up some of the steel work. Thus the angle brackets used to stiffen up the bottom of the staircase, instead

of being stamped out of sheet metal, which would naturally produce a considerable amount of scrap, are made by welding strip metal together at the angle of the bracket.

Another instance of the use of the blow-pipe for building up purposes is the production of the hand rail standards for the staircases. These standards are cut from a dwarf T section steel—as shown at A in the line sketch—and have to be drilled in several places for fastenings. In order to compensate



CONSTRUCTING HAND RAIL STANDARD BASES

for the metal removed at the hole the web is first milled right away, as shown at B—and a little cheese, cut from a round rod, is then welded into the gap—see C. The arrangement makes a very neat finish, and is better than merely building up the sides of the web round the hole, as the size of the boss is definitely settled by the diameter of the stock from which the cheeses are cut, and is not dependent on the whim of the workman.

The flitch plates, brackets, hand rails and so forth are all made in the same systematic manner as the other parts, and are sent to their respective stores. Thus there is a store for omnibus parts and another separate one for each type of car. In these stores the parts are grouped in bundles to represent single bodies, or definite parts of bodies, and charts are kept to show the extent of the stock in hand.

When a body is put in hand the workman goes to the store and is handed out a bundle, which may, for instance, represent all the material for a complete side. He is also given a tray in which, in separate compartments, there are all the screws, nails, nuts and bolts, washers, &c., necessary for putting the unit together. The trays are plainly marked with the name of the job to which they apply, and each compartment is labelled according to its contents. It is thus a simple matter for the storekeeper to take the trays round the stock bins and fill them with the exact amount of supplies required for the job.

ASSEMBLING.

The omnibus bodies are assembled, in several separate operations, in the larger building seen on the right of the bird's-eye view. The floor of the omnibus is made as a complete unit, as are also the ends, sides, roof, the staircase—which comes complete from a separate shop—the canopy over the driver, and the dashboard.

Each unit is put together in a jig which defines the positions of the separate members and ensures all the joints coming together squarely. The floor, for instance, is laid out on a couple of stout timbers, which are fitted with hard-wood cleats for holding the transverse floor beams. The bottom rails are then fixed on the ends of the beams, the floor boards are nailed down, and piece by piece the whole unit is built up. The roofs are made on other jigs—see Fig. 3—and have two thicknesses of boarding, about ¼in. thick, with a waterproof sheet of Rubberoid between. Fairly wide planks are used, to minimise the number of joints where the weather might get in, and care is taken to stagger the joints of the two layers. The frames for the sides and ends are made close by—see Fig. 4—and in these cases the jigs are rather more elaborate on account of the curved surfaces of these parts, but the general principle is the same.

Some of the members are flitched, that is to say, a hard steel plate is sandwiched in between two pieces of wood, and the whole bunch clamped together with wood screws. The wood comes ready drilled from the mill. The flitch plate is slipped in place and is drilled in a high-speed machine. Long wood screws, with shanks long enough to go through the plate, are then dropped into the holes, and are driven home in the drilling machine by a screwdriver equipped with a slipping clutch to prevent them being overdriven. The protruding threaded part of the screw is then clipped off and peened over with a hand hammer.

When a floor has been completed it is picked up by an overhead crane and set down on trestles, the frameworks for the sides and ends are carried over by hand and put in place, while the roof is dropped on by the crane—as shown in Fig. 5. The three-ply panelling is then fixed, and here the merit of having the screw holes drilled in a jig becomes quite obvious. The framing is naturally obscured when the panel is put in place, but the workman need not feel about to find where it is before he puts a screw in. He knows that if he puts a screw in one of the holes there will be a frame behind to receive it.

At about this stage the painting is started by the screws being stopped and a priming coat applied, while the fitting of the staircase, top deck seats, hand-rails, &c., goes on concurrently. In this connection we were told of a rather peculiar phenomenon. The stopping over the screw heads, they are brass screws, sometimes gives a lot of trouble through peeling off after a few days. The trouble may persist for, say, a week, but then disappears without any apparent reason.

STACK OF ASH LOGS IN THE TIMBER YARD OF SHORT BROS. WORKS

PAINTING.

When an omnibus body has been completed it is picked up by the crane—see Fig. 6—and is taken away to the paint shop, part of which is illustrated in Fig. 7. Here it is rubbed down, painted and finally varnished. We noticed that the new American waterproof sandpaper was being used for rubbing down, with a copious supply of water, and were told that it is a great improvement on the old dry process, as no dust is produced. In the foreground of Fig. 7 there will be observed an electric light standard. A considerable number of these lamps are used in the paint shop and are stood on the floor, at the door of the omnibus, to project a light inside without it being necessary to trail a portable light, with its generally dirty flexible connection into the omnibus.

There is a separate paint shop for the standard motor car bodies. It is at the end of the erecting shop—as shown in Fig. 8—and is really a screened off part of the main building. The ceiling of this paint shop, it will be noticed, is carried by Belfast girders, and is made entirely of glass laid at the level of the tie members of the girders. The result is an excellent illumination of the interior, while close-fitting doors keep out any dust. Behind the paint shop and outside the main building there are two chambers in which the bodies are dried after painting and varnishing. These chambers are kept at a temperature of 130 deg. F., while the air is humidified up to 60 per cent. of saturation in two plants by the Carrier Company. The precautions taken to prevent the varnish on the bodies being spoiled by dust may be gauged by the fact that the air conditioning plants, now fixed in rooms on the roofs of the chambers, are to be moved to foundations on the ground alongside, so as to eliminate any possibility of vibration shaking dust down out of the chamber ceilings. Ground is just now being cleared at the base of the chalk dump for an extension of this paint shop.

The motor car bodies are mounted on their chassis in the works, when they are completed, and the vehicle is then ready for the road; but in the case of omnibus bodies they are generally taken away from Rochester on "travelling chassis" of the omnibus company and mounted on their proper chassis at the works. In this condition each body weighs about 28 cwt., and is quite complete except that the electric light fittings are required—the wiring is installed—and the usual advertisements are missing. From the time of starting to assemble an omnibus body to its departure from the works nine days generally elapse, so that with normal working at the present rate of output the shops must be able to accommodate about forty omnibuses at one time. As a matter of fact, there is ample accommodation in the omnibus bay for well over fifty bodies, as may be seen from Figs. 9 and 10.

Our two remaining illustrations—Figs. 11 and 12—which represent the machine shop, are not so directly concerned with the building of omnibus bodies as are the others; but these shops are naturally essential to the maintenance of the equipment of the other departments, whilst a considerable amount of general engineering work, including the construction of the trackless electric cars, already referred to in this article, is carried out there.

Taken altogether, the works struck us as a most excellent example of the conversion of a war-time factory for peace-time manufacture of an intensive type, but in it, nevertheless, the system is not so inelastic that changes in design cannot be readily accommodated. It will be noticed from our illustrations, for instance, that the design of the omnibus bodies is different in different views, yet the photographs were all taken within a few weeks of one another.

A Large Electric Coal-winding Plant.

WHAT, it is claimed, will be the most powerful coal mine winding plant in the world is to be installed at Orient No. 2 mine of the Chicago, Wilmington and Franklin Coal Company, at West Frankfort, Ill. A contract for this winding plant has recently been awarded to the American Westinghouse Electric and Manufacturing Company and the Nordberg Manufacturing Company, the former of which will furnish the complete electrical equipment for the plant.

The plant contracted for will be twice as large as any coal mine winding installation in North America at the present time. The most powerful coal mine winding plant in that country now is equipped with a winding motor having a capacity of 1400 horse-power, whereas the combined capacity of the two motors for the Orient No. 2 mine will be 4400 horse-power. One motor will be mounted at each end of the drum shaft, and each motor will have a capacity of 2200 horse-power at 40 deg. Cent. rise.

At the Orient mine the coal will be wound in skips, each skip having a normal capacity of 22,000 lb. and a maximum capacity of 26,000 lb. The depth of the shaft is 607ft., and the coal is dumped from the mine cars at the bottom of the shaft by means of rotary dumps. Numbers of unusual features have been worked out for the mine, chief among which are the very large capacity and the high rate of winding. Under normal conditions, the output per hour will be 1500 tons, but under maximum conditions that output can be increased to 2000 tons per hour, which is greater than the output of the majority of coal mines in the United States, that have an output of much less than 2000 tons in eight hours. The maximum winding speed to be obtained will be over 4000ft. per minute. Operation will be at exceptionally high speed, the entire working of a single cycle from the time the skip starts from the bottom until it reaches the dumping position at the top requiring only sixteen seconds. This high speed of operation will involve very heavy peak loads during acceleration and heavy regenerative loads during retardation. The actual load during acceleration will be about 8000 horse-power, and the regenerative load during retardation about 4000 horse-power.

Power will be supplied to the winding motors through a fly-wheel motor generator set, equipped with two 1800-kilowatt, 600-volt, 600 revolutions per minute commutating pole, compensated-wound direct-current generators, driven by a 2200 horse-power, 2200-volt, three-phase, 60-cycle, 600 revolutions per minute, wound-rotor induction motor. The motor generator set is to be equipped with a fly-wheel, 12ft. in diameter, weighing just over 40 tons, and built up of steel plates.

The control of the winding plant will be exceptionally well provided with safety devices, while automatic acceleration and retardation are also included. All possible contingencies are, it is claimed, to be provided for, so that it will be practically impossible for trouble due to careless operation or wrong manipulation of the hoist and brake levers by the winding operator to occur. In case the operator should be incapacitated at any time, the winding engine will automatically slow down and come to rest without causing any damage whatever to the equipment.

Although the maximum variation in power during a cycle at the winding motor is from 8000 positve to 4000 negative, the power drawn from the power system by the alternating current induction motor will remain practically constant at about 2000 horse-power, which is, of course, the result of employing a fly-wheel which will give up energy during the retardation period.

The Stanton Spun Iron Pipe.

THE standardised production of cast iron pipes by means of the centrifugal casting method marks the most notable advance in pipe foundry engineering which has taken place in recent years. Prior to the introduction of the new method which we are about to describe, pipe moulding was a process involving the use of sand loam and other agents, with the requisite preparing and drying appliances. The moulding boxes and core boxes were large and cumbersome, and the length of time required to prepare and dry the sand moulds added largely to the cost of the pipe produced. Compared with the sand-casting system which has been carried on for so many years with but slight departures from the original methods, the new process may be regarded as revolutionary, since if we except a small core used to form the socket of the pipe, the spun pipe is produced without sand or core. From time to time efforts have been made to simplify the process of pipe moulding, and in THE ENGINEER of May10th, 1912, a method of casting pipes without the use of cores was described. This method was introduced by Mr. Hermann Molinder, of Soderhamn, Sweden, who used a rotating sand-lined mould, into which the molten metal was poured from either end. Sound cast iron pipes were produced in this way.

In 1914 M. Sensaud de Lavaud, a Frenchman and a graduate of L'Ecole Nationale des Ponts et Chaussées, who was then living at San Paulo in Brazil, devised the form of centrifugal pipe-casting machine which we here describe. During the last seven years a considerable amount of work has been done on the perfecting of the machine and the manufacturing process, and important developments have simultaneously taken place in Great Britain, Canada and America. In England the Stanton Ironworks Company, Limited, has secured the manufacturing rights of this process for the British Empire—excluding Canada—and also for the Continent of Europe, while in Canada pipes are being made on the De Lavaud system by the National Iron Corporation, Limited, of Toronto, and in America a similar plant has been installed at the works of the United States Cast Iron Pipe and Foundry Company. The Stanton Ironworks Company, Limited, has not only secured the use of the De Lavaud patents, but has laid down an entirely new plant for the economic and scientific manufacture of spun iron pipes.

THE STANTON SPUN IRON PIPE PLANT.

The general lay-out and arrangement of the plant is clearly illustrated by the plan reproduced in Fig. 1, while characteristic views taken in the works are shown in Figs. 3 to 11 on page 105. The keynote of the design of the new foundry is simplification in the handling of materials, from the time the necessary iron, coal, and coke, are delivered on the site until, having passed through the various stages in manufacture, the finished pipes are loaded on rail for despatch. The overhead bunkers, into which the raw materials are discharged from the railway wagons, are shown in Fig. 3. Ten bunkers are in use with the present plant, and they each have a sufficient capacity to hold 15 tons of coke, 40 tons of coal, 100 tons of pig iron, or 80 tons of limestone. Bottom discharge arrangements are fitted, and below the bunkers are rail tracks serving the charging hoists of the cupolas and gas producers. The exact amount of each constituent is withdrawn from the overhead hopper into a skip mounted on an electrically operated two-ton travelling carriage, which runs beneath the bunkers; the amount of material delivered to the skip is automatically weighed as it is delivered, a constant mixture producing an iron of uniform

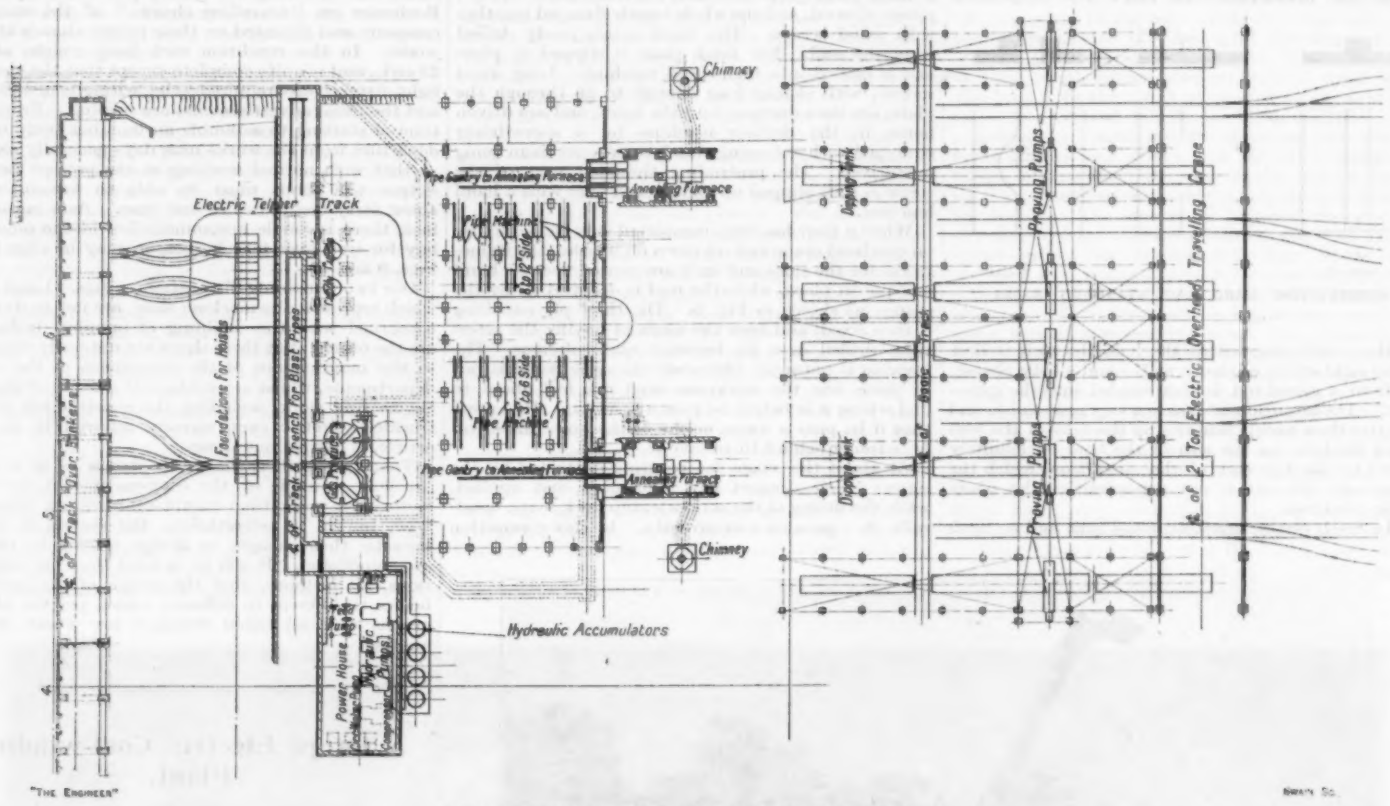


FIG. 1—GENERAL LAY-OUT OF THE PIPE CASTING PLANT

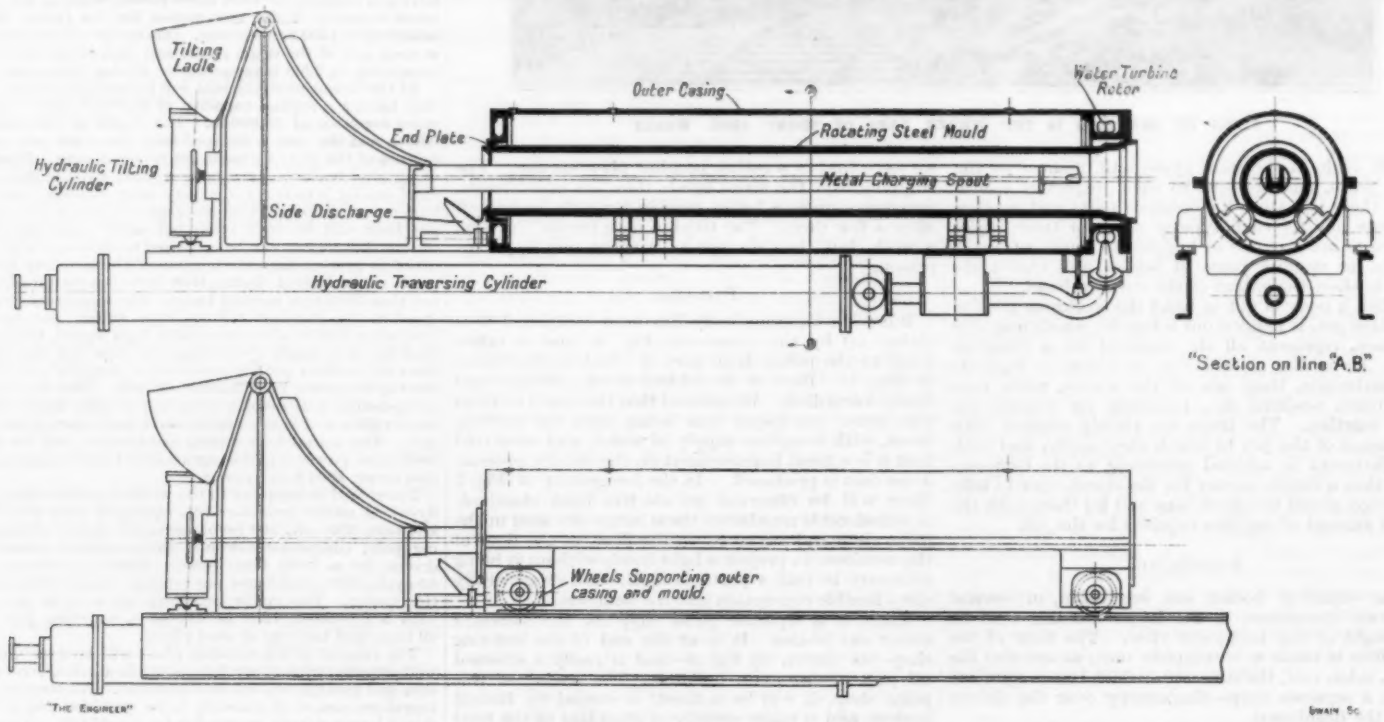


FIG. 2—SECTIONS AND SIDE ELEVATION OF THE STANTON DE LAVAUD PIPE CASTING MACHINE

quality being thus ensured. On reaching the hoists the skip is removed from the carriage and elevated by hydraulic gear to the charging platform, where its contents are automatically tipped into the cupola.

The cupolas illustrated in Fig. 4 were supplied by Simon Carves, Limited, of Manchester. They are of the most modern design with drop bottoms, and are 54in. in diameter inside the linings. Each has a melting capacity of about 10 tons of metal per hour. The metal is tapped from the cupola into ladles which are carried by five-ton electric overhead Morris-type telpher cranes, to the casting bays. Illustrations Figs. 6 and 7 show one of these ladles at the cupola and at the pipe-casting machine respectively.

FIG. 3—OVERHEAD STORAGE BUNKERS

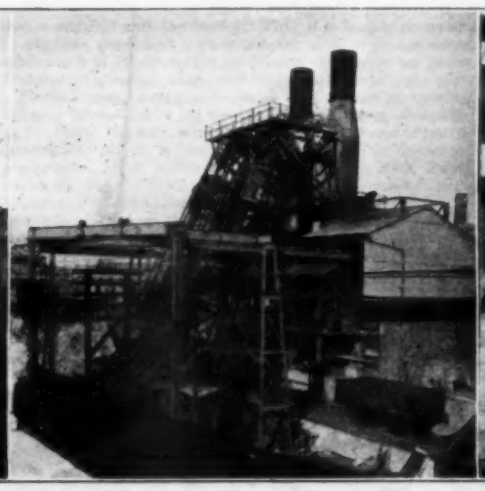


FIG. 4—CUPOLAS AND CHARGING GEAR

FIG. 5—GENERAL VIEW OF PIPE CASTING MACHINE

FIG. 6—CUPOLA PLATFORM

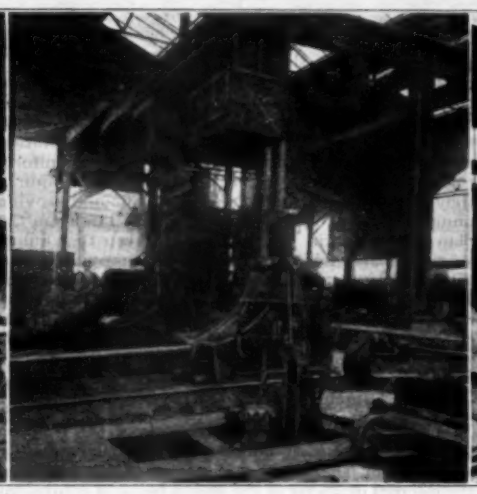


FIG. 7—LADLE-TIPPING GEAR AT MACHINE

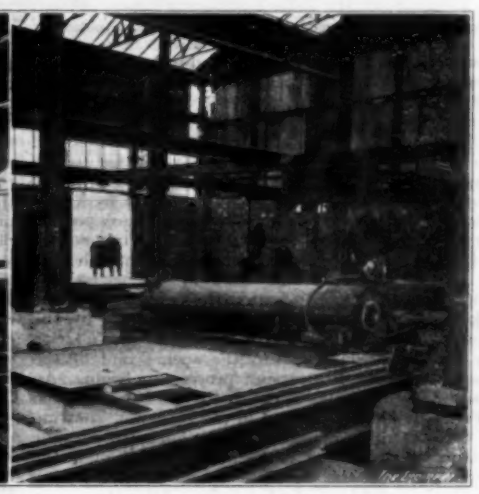


FIG. 8—PIPE MACHINE SHOWING SIDE DISCHARGE

Before describing the machine and its construction, reference may be made to the power-house alongside the gas producers and cupolas where the necessary machinery for furnishing hydraulic power, and also the boiler-feed and circulating water pumps and fans are installed. The fans for supplying the cupola blast are of standard pattern with 16in. discharge branches, each having a capacity of 6000 cubic feet of air per minute at a pressure of 16in. to 30in. water column, and they are coupled direct to 55 brake horse-power electric motors. Two sets of three-throw motor-driven hydraulic pumps, with rams 3½in. diameter by 9in. stroke, supply power to the hydraulic hoists. Each pumping set is designed for an output of 56 gallons of water per minute at 850 lb. per square inch pressure, but under normal conditions the pump works at an output of from 45 to 50 gallons of water per minute at the above-mentioned pressure. Two boiler-feed pumps of the multi-stage centrifugal type are provided, and work in connection with the Thompson waste heat boilers at the annealing furnaces. Each of these pumps has a capacity of approximately 600 lb. of water per minute against a head of 460ft., and is driven by an electric motor at a speed of 1060 revolutions per minute. There is a further hot-water circulating pump of the 5in. multi-stage type, working at a pressure of 150 lb. per square inch. The hydraulic power for operating the pipe-casting machines is furnished by a multi-stage pump driven direct by an electric motor. This pump has an output of 1000 gallons per minute at a pressure of 150 lb. per square inch.

The gas producers for the annealing furnaces are of the Chapman floating agitator type, with a water-sealed bottom 11ft. in diameter. Each producer has a capacity of about 24 tons per day, and the gas which is produced by the steam process has an approximate calorific value of 225 B.Th.U. per cubic foot. The two annealing furnaces were specially designed by Simon Carves, and are combined with Thompson waste heat boilers having an approximate evaporating capacity of 2500 lb. per hour. Each furnace is capable of dealing with twenty to forty pipes per hour, depending on the size, and of maintaining them at a temperature of 1800 deg. Fah.

The general construction of the Stanton de-Lavaud pipe casting machine will be seen from the various

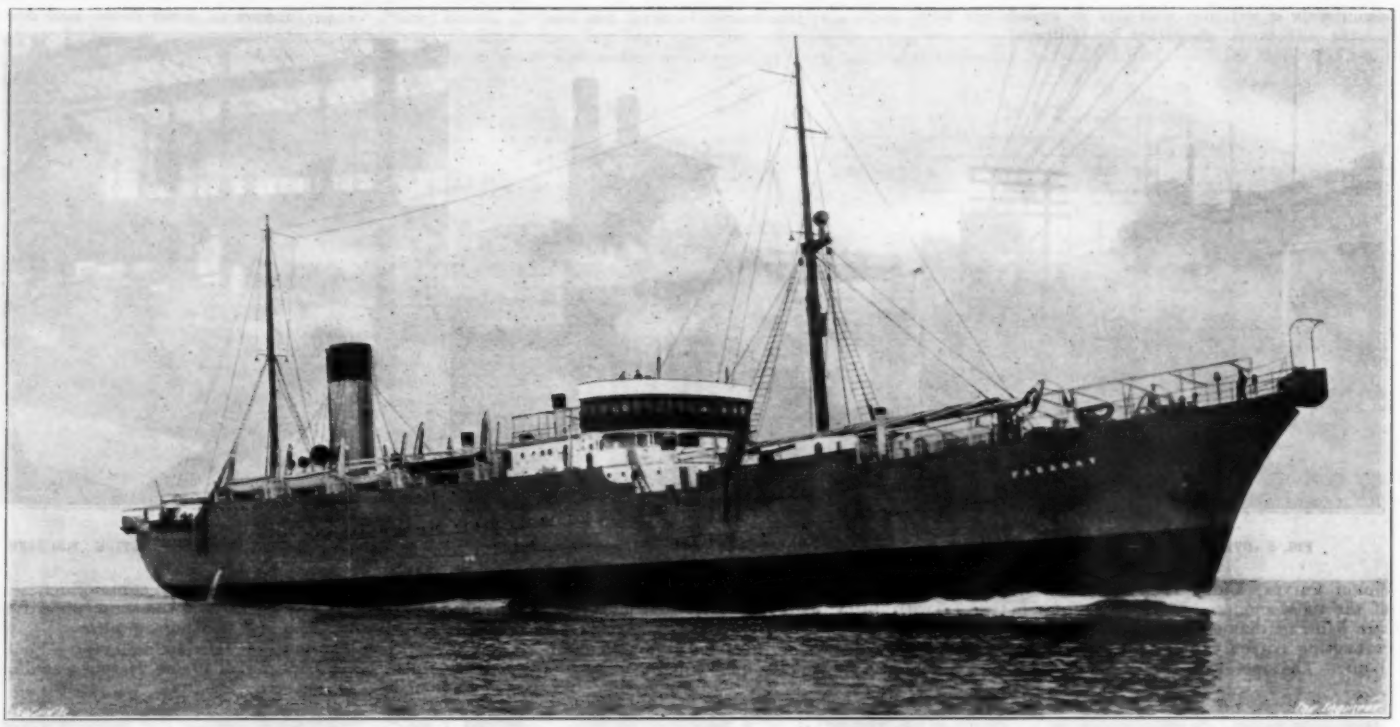
FIG. 9—REMOVING CAST PIPE FROM MACHINE

FIG. 10—PIPE ENTERING ANNEALING FURNACE

FIG. 11—HYDRAULIC TESTING PLANT

THE NEW CABLE SHIP FARADAY

PALMER'S SHIPBUILDING AND IRON COMPANY, LIMITED, JARROW, ENGINEERS AND BUILDERS



views reproduced in this article, and from the drawing given in Fig. 2. The machine consists essentially of a metal casing containing a water-cooled steel mould, which is rotated by an impulse water turbine fixed at one end of it. Molten metal is introduced into the rotating mould by a long cantilever trough or spout which, in turn, receives its supply of metal from a tilting ladle which is controlled by hydraulic pressure. The only core used in the entire process is a small sand core for shaping the inner part of the socket, which is carried on a plate attached to the extreme end of the mould; otherwise the rotating steel mould forms the outside of the socket and the whole of the pipe body. In the drawing referred to, the machine is shown with the charging spout near to the socket end of the mould ready for the casting process to begin. An outside view of the machine in this position is given in Fig. 5, while the top end of the machine, showing the vertical tilting cylinder and the various hydraulic controls, is illustrated in Fig. 7. In this view the tilting ladle on the machine is shown while being filled with metal from the hot ladle. After the socket core has been fixed and the machine set in motion, the tilting ladle is raised by hydraulic means and molten metal flows down the cantilever spout to the bottom end of the mould forming the socket. It may be mentioned that the machines are erected on a slightly sloping bank, so that the requisite fall is given to the metal. As soon as the flow has started, the rotating mould and casing is traversed away from the tilting ladle at such a speed that the molten metal lines the inside of the mould throughout its entire length. When the mould has reached its extreme position and the cantilever spout is fully withdrawn, any metal or slag remaining in the tilting ladle is diverted into the side discharge, shown in Figs. 2 and 8. On completion of the cast the mould is rotated for a further period of about 15 sec., after which the cooling effect causes sufficient shrinkage to enable the pipe to be withdrawn from the mould. This operation is accomplished by securing the red-hot pipe at the socket end and allowing the machine to traverse backwards to its original position, which is clearly shown in illustration Fig. 9. The completed pipe is now slung from an overhead gantry and transferred to inclined rails leading into the gas-fired annealing furnace shown in Fig. 10.

The object of the annealing process is to remove any initial strains caused by the cooling of the metal against the sides of the mould, and further to restore the homogeneous character of the spun iron. The pipes enter the furnace, which is arranged on a slight incline so that the pipes roll through the furnace by gravity, their speed being controlled by mechanically operated conveyor chains, which are provided with projecting fingers. The rolling of the pipes in the furnace serves two purposes. First, it ensures the complete annealing of the pipe; secondly, it maintains the perfect circular form of the pipe.

As an example of the uniform thickness and truly circular form of the spun iron pipes, we may mention that when these pipes are to be lined with concrete, during which process they are revolved at a high speed, they run perfectly in balance.

After annealing has been effected the continuously moving pipes are allowed to cool in the last part of the furnace, and they emerge from it at a "black" heat, convenient for dipping. They are then conveyed direct to a sunk bath of Dr. Angus Smith's composition. By the use of a simple mechanism, each pipe is passed through this solution and is rotated during the process, so that a uniform coating of composition is given. After draining, they pass to the hydraulic testing station and proving pump, a view of which is given in Fig. 11. From the plan view given in Fig. 1, it will be seen that ample storage space for finished pipes is provided, and that by means of a bogie carriage, pipes may be transferred to any part of the storage yard. Loading into wagons is facilitated by a two-ton overhead electric travelling crane, which serves the whole of the loading road.

"SPUN" PIPE CHARACTERISTICS.

The form and general dimensions of the Stanton "spun" iron pipe follow the British standard specification, the external diameter of the pipe and the internal diameter of the socket being of equivalent dimensions. This means that the spun iron pipe can be joined up with ordinary sand-cast pipes of similar dimensions without any difficulty. The new method of manufacture makes it possible to produce pipes approximately 25 per cent. thinner and lighter than ordinary sand cast pipes. On account of the centrifugal action, which gives an iron very dense in structure and entirely free from porosity, the tensile strength is at least 70 per cent. greater with a higher factor of safety. Compared with the results obtained from the ordinary vertical sand-cast pipe, average tensile tests made on spun pipes show a strength about double the usual 9½ tons. With bending tests made with bars ¾in. by 1in., cut from a pipe and supported between 12in. supports, an average breaking load equivalent to 41.3 cwt., as against the 28 cwt. required by the British standard specification, has been obtained. Further interesting characteristics of the spun metal pipe are the ease with which it is machined and the full thread which is obtained when a pipe is drilled and tapped. The inner surface of the pipe is smooth and hard, and is less liable to corrosion than the surface of a sand-cast pipe.

Up to the present the Stanton Ironworks Company is manufacturing and stocking spun pipes in sizes of 4in., 5in., 6in., 7in., 8in., 9in., 10in., 12in., 14in. and 15in. in diameter, the length being in all cases 12ft. With the experience which has been obtained in developing the process, there seems no reason why pipes of even larger diameters and greater lengths should not be made.

AN explanation for the delay in starting on the extension towards Guildford of the London and South-Western section electrification, to which attention was drawn on page 48 of THE ENGINEER of July 13th, may possibly be found in the public notice given by the London Electric Supply Corporation, that it has applied to the Electricity Commissioners for an order authorising the Corporation to supply electricity for working and lighting railways, to the Southern Railway Company. All three sections of the Southern Railway are covered by the proposed Order.

The Siemens Cable Ship Faraday.

THE launch of the Siemens new cable ship Faraday from the Jarrow yard of Palmer's Shipbuilding and Iron Company, Limited, was recorded in THE ENGINEER for March 16th, when we outlined her main features.

The vessel is now alongside the Woolwich works of Siemens Brothers and Co., Limited, where she is loading some 1000 miles of submarine telegraph cable in readiness for her maiden voyage early in the coming month. On Monday last we accepted the invitation of the company to inspect the completed ship and the process of cable making at Woolwich; also the extensive and highly specialised works which have been laid out for manufacturing telephones and auxiliary electrical apparatus.

The illustration above serves to show the general appearance of the new Faraday. She is of the shelter deck type, with freeboard, and has a net tonnage of 2610 tons, with a length between perpendiculars of 380ft. The propelling machinery is placed aft and comprises a twin set of triple-expansion engines designed to develop 2960 indicated horse-power at a speed of 88 revolutions per minute. Steam is generated in three single-ended boilers, at 180 lb. per square inch, and the boilers work under forced draught and are fitted for oil burning. Accommodation for the officers, cable staff and crew, numbering in total over 150 persons, is provided in well-appointed cabins on the upper and shelter decks.

On page 98 we reproduce illustrations showing the cable hatches and troughs and also the paying-out machinery with the dynamometer, jockey gear, and the stern sheaves. The main cable, or picking-up machinery, is placed forward on the upper deck so as to serve the cable on the shelter deck above, which deck forms a working platform for cable repairing, testing and jointing. The testing room is placed in the forward accommodation on this deck, and in front of the main cable machinery hatch are dynamometers for registering the pull of the cable. The bow of the ship is furnished with three cable sheaves.

There are four cable tanks approximately 42ft. in diameter and about 26ft. deep, the forward tank being slightly smaller than the other three. These tanks have been designed for a total capacity of about 4500 tons of cable, and at the present time 250 miles of cable is being loaded into each tank, representing a total weight of nearly 4000 tons.

The tanks are equipped with a central water-tight steel cone, and all internal surfaces are finished flush so that no damage is done by the cable coming in contact with them. Forward of the cable tanks there is a large hold fitted out to receive buoys and other gear incidental to cable works.

Reference may be made to the roomy navigating bridge, and the instruments placed there. In addition to the telemotor controlling a steam steering gear of the Wilson-Pirrie type, there is a Siemens electric helm indicator which shows the angle of the rudder on a dial apparatus fixed on the navigating bridge. Other Siemens marine auxiliaries are the ahead and astern indicators, showing the first and every revolution as well as the direction of rotation of the engines, and the look-out indicator enabling the look-out man to signal to the bridge the position of any object he observes. Another interesting apparatus is the indicator for navigation lights which shows the number of lights burning and the intensity of illumination with a bell alarm in case of any light failing. On the upper bridge we noted a 9ft. base Barr and Stroud rangefinder of the mercantile type, an instrument which is finding increasing use on the newer ships.

The first work to be undertaken by the new Faraday is the laying of the new cable between Nova Scotia and New York. This cable belongs to the Commercial Cable Company, Limited, and has been designed for fast working. It is a single core cable insulated with gutta-percha, the

weight of the copper conductor being about 450 lb. per nautical mile. As the cable is to be laid in water of varying depths and a large part of it passes over fishing grounds where it is liable to be disturbed by ship's anchors, special precautions have been taken with regard to the armouring, which is of eight different types.

The vessel makes its first voyage under the command of Captain Gange, the master of the old Faraday, and the cable engineers, Mr. A. C. Stopher and Mr. N. Elliot, will also accompany the ship.

Smoke Abatement in Hamburg.

THE Hamburg Smoke Abatement Society now numbers nearly 600 subscribing members, and has 2300 steam boilers under its control. It is remarkable that the supervision of such a large number of steam-raising installations can be undertaken with a technical staff of only seven; and this fact shows the wisdom of this form of supervision for small steam boiler plants. Herr Nies, the chief engineer of the Society, in his introductory remarks to the report for 1922, states that the chief feature of that year was the use of English coal for many of the Hamburg factories owing to the scarcity of fuel in Germany, and he notes the fact that this change was welcomed by the stokers, since English and Scotch coal compares favourably with that to which they have been accustomed.

Many of the installations which had been obliged to burn the much poorer and leaner German coals and to use blowers for obtaining good combustion of these high ash fuels, were unsuited for the use of the English and Scotch coals with their much higher percentage of hydrocarbons. The furnaces of these boilers and the methods of firing had to be altered considerably, before it was possible to avoid smoke formation as a result of the change. Methods of providing a secondary air supply, either through the door and over the fuel bed, or at the bridge wall, are described in this report, and the use of a steam jet for mixing purposes is recommended for the furnaces of water-tube boilers where no baffles or arches are provided over the grate.

Another branch of the Society's work in 1922 related to improved methods of burning low grade and waste fuels, upon which many of the works and factories in Hamburg had to fall back.

The education and training of stokers and firemen in the theoretical and practical side of their work remains a most important part of the Society's efforts, and the bonus system of payment introduced some years ago is still found to be of great value in encouraging the firemen and stokers to take an interest in their work, and to strive after higher and higher efficiencies. The advantages of the Hamburg system of ascertaining the bonus by measurement of the heat losses at the chimney are summarised by Herr Nies in this report as follows:—

(1) The economies which result from this system have been proved, by all the tests made in recent years, to be permanent and not temporary in character.

(2) These economies vary from 5 up to 15 per cent. of the fuel used before the system was introduced, and on the average lie between 10 and 15 per cent.

(3) The improvement of the intelligence and skill of the firemen and stokers communicates itself to other ranks of the boiler-house and engine-room staff; and the efficiency of the whole power-house is raised in consequence of the work done in the boiler-house.

(4) The payment of the bonus leads the owners and managers of the plant to study the literature of the subject of heat generation and utilisation in the boiler-house, and also leads them to study the allied subject of testing apparatus, and the selection of types which will prove accurate and durable under the conditions to which they are exposed.

(5) As regards the effect on the firemen, the bonus payment leads them to take a much greater interest in their work, and also tends to improve their status and their pride in their calling.

(6) The capital cost of the required apparatus is negligible, when compared with the advantages gained, and does not exceed 10 per cent. of the value of the fuel saved.

(7) The daily costs for supervision are also negligible, if one man is employed to make the tests at a group of small factories or works near together. One of the test engineers of the Hamburg Society has taken charge of six works in this way, and has made the necessary tests once or twice daily (according to the shifts worked), and has filled up the log sheets and calculated the bonus weekly, for these six factories, without difficulty.

Herr Nies refers, finally, to the steam-raising tests that were carried out by the Society in Hamburg during 1922 with peat upon ordinary horizontal grates, either alone or mixed with coke, and states that very satisfactory results were obtained. The subject of domestic heating also received attention, and lectures were delivered upon the possible economies that may be effected by improvements on the present methods, and by use of central heating in place of separate stoves.

Electric Lighting.

EVERY lighting expert knows that in spite of all modern developments in the manufacture of electric lamps, innumerable buildings are very imperfectly illuminated. This is attributable in a very large measure to the users of modern electric lamps failing to appreciate that high candle-power lighting units should be used in conjunction with proper fittings designed to eliminate glare and undesirable shadows. There are also, of course, a certain number of ignorant contractors who seem to think that all that is necessary to illuminate a building is to suspend gas-filled lamps from the ceiling. Bright lights in the field of vision not only make it difficult to see objects plainly, but are also very detrimental to the eyesight. Much has, of course, been written on the proper method of using high-power gas-filled lamps, but it is by no means difficult to find instances in which all the recommendations of illuminating engineers have been ignored.

Old shades, which were designed in the days of carbon filament lamps, are very often used in conjunction with modern high candle-power lamps, and the results naturally fall a long way short of what they should be. The intensity of illumination is also very often much too low, and the conditions under which many workpeople perform their duties are dull and depressing. This, it is hardly necessary to explain, results in a poor output, and in places where machinery is in operation, accidents are liable to occur. There is no question that good illumination has a stimulating effect upon workpeople, and an increase in existing lighting intensities is no doubt, in many cases, desirable. Tests have shown conclusively that increased lighting intensities, above average values, results in increased production. But whilst the electrical firms have issued innumerable publications on the advantages of good illumination, and whilst much has been said and written on how adequate and otherwise good illumination can be obtained, comparatively little has been done in the way of giving practical demonstrations. The British Thomson-Houston Company has, however, made a decided step forward in this direction. At No. 15, Savoy-street, W.C., a very extensive and elaborate demonstration department has been established where people who are interested can see exactly how electric lighting work should be carried out.

During a demonstration which we attended last week, charts were shown giving the results of investigations carried out by physicists and others, and indicating that vision in all its aspects is considerably assisted by high intensity lighting. The effect of lighting on the speed and accuracy of vision was dealt with. An experiment was made with an open box containing a revolving table on which a cardboard cylinder was mounted. On this cylinder letters were printed so that they could be followed with the eye as the cylinder revolved. On illuminating the cylinder at intervals with electric lamps of different candle-powers, the speed of the cylinder appeared to vary and to decrease as the illumination was increased, thus showing that the eye can see more quickly with high illuminating intensities. Production, it was shown, has increased from between 10 to 25 per cent. where modern high intensity lighting has superseded lighting of the average standard.

The dull and depressing effects that are produced by the use of obsolete lighting arrangements and the steps that are necessary to build up an efficient modern lighting system were well demonstrated. Perfect illumination, with absence of glare and harsh shadows, was finally produced with the aid of the company's dome reflectors and bowl enamelled lamps. To enable those present to appreciate the quantitative value of the illumination under different conditions, each member of the party was provided with a foot-candle-power meter. Around the demonstration room cabinets were arranged for showing different lighting effects, such as the effect of light on the colour of objects, the effect of glare upon the eye and so forth.

Demonstrations and investigations are, we understand, to be carried on indefinitely. This so-called lighting service department of the company is a permanent department which will constantly be engaged on the investigation of lighting in all its aspects, and from time to time the public will receive information concerning these investigations in specially prepared handbooks. The demonstrations are not being carried out for the purpose of selling any particular class of apparatus, but merely with a view to showing in a general way the advantages of better lighting and the manner in which it may be obtained. For the movement to be successful, it must have the assistance and co-operation of supply companies, contractors and manufacturers of lighting equipment, and Mr. W. E. Bush, who is at the head of the department, will be pleased to hear from those who are interested in the work.

A HEAD-ON RAILWAY COLLISION.

THE Ministry of Transport published, on the 14th inst., the report by Major Hall on the circumstances that led to a head-on collision on the Great Western Railway on April 25th. The scene of the accident was at Curry Rivel Junction, between Athelney and Langport on the Westbury-Taunton main line, where there is a junction, with facing points in the up main line, for Yeovil. A down goods train had been shunted off the down main line through the main line crossover-road on to the line to Yeovil, and when it was allowed to proceed the signalman again set the Yeovil Junction points so that they lay for the goods train to leave the branch and lowered his starting signal. He omitted, however, to open the crossover-road for the train to return from the up to the down line, and he did not attempt to lower the signal at that point, or his failure would have been revealed. The driver was told to proceed, and was more than once assured that the road was clear, for he was within speaking distance of the signal-box. The train started and, to quote from the report, "as soon as Steer (the driver) got the couplings tight and made a good start, he took out his watch, reached for the book on the rack, booked the time and notched up the engine. Directly he had done so he missed the road on his right and, realising that he was on the wrong line, shut off steam, sounded his brake whistle—which was heard and acted upon by the guard, Osborne—and applied the brake." Unfortunately, the signalman had accepted an up motor train before he allowed the goods train to depart. The engine-men of the motor train saw the other train and managed to stop when the goods train was 50 yards away. In the subsequent collision, the goods train drove the motor train 190 yards backwards. The engine-men of the latter jumped off after stopping their train, but nine passengers suffered from shock and minor injury. In addition to the driver of the goods train failing to see that the points of the crossover and its signal were not made for him, and to the signalman failing to set the road, the latter was responsible for a breach of the block regulations in allowing the goods train to foul the up line after he had accepted the motor train.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

General Conditions.

THE depression in the iron and steel industries of the Midlands continues, and small orders and unremunerative contracts are the rule. Supplies of raw material for the engineering trades which the autumn customarily brings are not thought of. If they do enter into calculations, they occasion no anxiety. Production inevitably tends to exceed the absorptive capacity of the market, with the consequence that prices are being undercut as fast as they are readjusted. The position gives cause for much concern, and it is realised that until the holiday season is past there is not much prospect of any real extension of business.

Steel Sections Reduced.

The expected revision in the Staffordshire price for steel sections has been announced in the shape of a reduction of 5s. per ton. This makes angles at date £9 15s., tees £10 15s., and joists £9 15s. For some time past there has been keen competition in the structural material branch of the steel market, and while some firms adhered to the Association figures, other firms who owed no allegiance to this body quoted cut prices and secured the business. This is the second reduction of 5s. which steel masters have been forced to concede in the past few weeks, and finished steel is now weaker than for many months past. The modernising of British plant has greatly increased capacity, while cheapening production, and, although profits are almost non-existent, the works are compelled to make concessions for orders. Almost the only steel section showing activity is that devoted to railway material, several of the rolling stock builders in the Midlands being busy. But this is mainly on foreign account, the leading home railways still keeping back their orders for rails and railway material. The recent reductions in semi-finished steel has brought a few orders, and steel makers, for the time being, have no effective competition from Belgium. Continental steel has become firmer in all departments, mainly on account of the very good bookings made in recent months with this country, another element, however, being the necessity to buy more coke at high prices in this country. Some of the Belgian quotations received this week offer billets at £7 17s. 6d. Native prices have, however, weakened further, and in some cases £7 15s. has not been refused. As continental billets makers could not compete with recent home prices, they have in many cases withdrawn quotations, so that the continued depreciation in native billet prices is a suggestive commentary on the situation of the trade in this country.

Scrap.

Scrap continues a stagnant market, many consumers declining to buy at any price. The nominal figure continues at £4 for heavy steel scrap, but sales have been made at £13 17s. 6d. delivered in South Wales. Consumers generally are holding off in the confident expectation of much lower prices. For steel turnings £3 is quoted. The material, however, is practically unsaleable.

Wire Rods Reduced.

Wire rods, which have been firm for some time, have now slumped rather badly. One producer still quotes £13, but rods can be bought from South Wales at £11 10s. delivered in this district. This is well below even the Belgian quotation.

Manufactured Iron.

There is no improvement discernible in the finished iron trade in this district, and the amount of plant wholly idle continues to increase. Many Staffordshire mills are almost unemployed. The demand for marked bars is limited, and the mills cannot see their way to employment very far ahead. It was expected that makers would reduce their standard of £14 10s., but they are evidently under the impression that in existing circumstances no compensating stimulus would be given to business by adopting this course. Prices are variable in the case of Crown bars. Some of the Staffordshire firms maintain the £12 10s. quotation, but others quote £12, while it is stated on some hands that even less would be accepted for a good order. Owing to the slump in the nut and bolt trade of the Darlaston district, bars are in very slow request. Lancashire makers are now willing to deliver in this district at £11, the price quoted for some weeks by Staffordshire makers. In these circumstances, some district firms are cutting the £11 price in the hope of securing the little business available. Belgian nut and bolt bars have become firmer at a minimum of £9 delivered. Some shippers, however, demand as much as £9 12s. 6d. This still leaves an ample margin in competition with Staffordshire iron. But the condition of the nut and bolt industry is so unsatisfactory that very little iron, either English or foreign, is called for at the moment. Makers of iron strip quote about £12 10s. While there is no longer any system of control in this branch, the recognised quotation for wrought iron gas tube strip in Staffordshire at date is £12 15s., and the acceptance of orders at £12 10s. is regarded as a divergence from the common understanding. Makers who adhere to the higher figure state that anything less would not cover their costs. Business is, it is stated, still passing on the old basis.

Galvanised Sheet Prices.

The galvanised sheet market continues to show weakness and prices are now lower than they have been for several months. While the nominal quotation is £17 15s., orders have this week been accepted at 5s. less. This industry has had a good run of orders for the first half of the year, but the outlook for the autumn is much

less encouraging, and makers are keenly looking out for new orders.

Pig Iron.

No Midland pig iron is being bought, except for urgent needs. Forge qualities are neglected, and foundry sorts are only required in small lots. A few heavy inquiries of larger tonnages than have been met with for some time are, however, said this week to be in the market. Prices continue to decline. The insecurity of the position is apparent to all. Some smelters who have seen fit to keep their plants idle till the outlook became clearer, both as to production costs and effective demand, have the satisfaction of knowing that they have had no part in accentuating what is described by most furnace owners as a "ruinous competition" for business at prices which have dwindled till they no longer represent an economic level. The question is whether the closing down of some of the furnaces now active can be staved off. This week a Midland furnace received an inquiry from the Continent for several hundred tons of foundry pig iron. As the material would cost about 15s. to convey from the furnace to the port, Derbyshire and Northamptonshire houses are very badly handicapped in competition with exporting centres like Middlesbrough or Barrow-in-Furness. The stocks at the Midland furnaces are understood to compare very favourably with other districts, being quite small. Derbyshire houses who have been demanding £5 for foundry material for some weeks past have now had to give way, and business has been done this week at £4 17s. 6d. Northamptonshire foundry iron has been sold at this price for a week or more.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

General Outlook.

THE progress of the iron and steel markets towards lower prices continues this week, but it is painfully slow, and those who desire that the fall may be quickened so as to bring nearer the time when a revival of trade can take place are regretting the absence of the old speculative markets which, in a time like the present, would have very soon forced prices down to the bottom. As it is, the market sags rather than drops, and the sagging process occupies months, during which no one can have any confidence in prices. There has been, so far, no improvement in the politcal outlook, although some people still seem to believe that the deadlock between France and Germany will be relieved in the near future. This, however, would not tend to raise iron prices, although it might bring about cheaper fuel, and thus enable ironmasters to produce metal at a price which consumers can pay, and to this extent the condition of the trade would be improved by a settlement between France and Germany.

Metals.

The non-ferrous metal market has been taking a turn for the better, although the improvement in prices has not gone very far yet. Apparently both in London and in New York a more optimistic feeling has sprung up about the future of copper, and this may easily give rise to a "bull" movement. So far as rough and refined ingot copper are concerned, prices are quite low enough to encourage a "bull" speculation when other circumstances are favourable. It is only in the manufactured section of the trade that prices are high. Of course, there are circumstances connected with the general industrial condition of the world which would prevent prices from running away, and these would probably limit the success of a "bull" campaign. It is reported that American stocks of copper are being absorbed and that trade conditions there are improving. The Indian market for manufactured metals remains very poor, but in the case of copper this is not because the price is extravagant, for the extravagant prices are kept for the benefit of the home consumer. The quotation for 4ft. by 4ft. copper sheets for India is still only £86 per ton, as against £100 for the home trade. Probably the reason underlying the poor buying from India is that Indian products cannot be sold to Europe to the same extent as formerly. The demand for scrap metals is still small and unsatisfactory, and the dealers have not yet increased their buying prices, although both copper and tin are better, and there is some improvement in the other metals. Scrap gun-metal seems more depressed than many of the other classes of scrap, and seems to be well worth the attention of those engineers who are in a position to use it. Old heavy yellow brass scrap is also comparatively cheap and seems to be much more worth buying than brass ingots, which are quoted at £48 per ton for 60 and 40 mixture. The market for lead has been rather better, but some people think that this is merely the result of the holding up of new arrivals by the dock strike, in which case we may see a reaction during the present week. It seems to be expected that more Mexican lead will soon be shipped to this country because of the fall in the price of American metal. Cable makers seem still to be taking a fair quantity of the metal, but other ways of consumption do not seem to be very good. The market is certainly quite high enough. The price of spelter has been steadily improving for some time. It is said that at present prices spelter does not pay the producer, and in America some severe steps have been taken to reduce the output. Continental offers are not very frequent now, and if there should be any improvement in consumption here, which is not very heavy at present, higher prices are quite possible.

Pig Iron.

The markets for pig iron are certainly rather more feeble this week, and there is a tendency towards lower prices, but no very definite change has taken place here. One reason for the easier feeling is the official reduction of Cleveland pig iron to 105s. on trucks, and the report that less is being taken. As the cost of coke in Cleveland is considerably more than it is in the Midlands, the price of 105s. is not so good for the Cleveland makers as is 100s. for the Derbyshire makers; and, moreover, it is probable that if Cleveland prices fell another 5s. some of the few orders for foundry pig in the North of Lancashire will no longer come to the Midland furnaces. The general belief here amongst buyers of pig iron is that prices must return to the January level, which means a drop of at least another 15s. per ton, and the only thing likely to prevent or delay this fall is the blowing out of furnaces. Buyers are now waiting to see whether or not this drastic policy will be adopted by the ironmasters. Merchants are still offering to sell pig iron for forward delivery at considerably less than the current prices, but one does not hear that much business is being done. Scotch pig iron is said to be a little easier here, but the usual quotation is still 125s. per ton delivered.

Steel.

The demand for finished material is poor, but one cannot say that there is much alteration in the prices quoted. There are reports of lower rates being accepted, but the ostensible quotations are much as they were, say, £9 17s. 6d. to £10 for joists and angles, £10 2s. 6d. to £10 7s. 6d. for plates, and £10 10s. to £11 for round bars. All Scotch works are closed for the holidays, but this has not caused orders to be more plentiful in the Midlands.

Scrap.

The demand for steel scrap remains very inadequate, and in Lancashire the price has dropped to about 65s. per ton on trucks. Heavy wrought scrap is steadier, and some of the iron manufacturers are still paying 80s. per ton delivered for it. Ironfounders are not buying cast scrap very freely, but dealers have not made any change in their prices, which range from 80s. to 85s. per ton delivered. The prices should not be lower even if pig iron does fall 15s. per ton.

BARROW-IN-FURNESS, Thursday.

Hematite.

To all appearances there is no change in the hematite pig iron trade, which is far from being bright. There is not likely to be any further restriction in output of iron, the balance which is not going out to customers going into stock. There is a belief that the market has struck bottom and that there will be no further falling off; in fact, there are a few who are inclined to predict a slight improvement in the early future. That remains to be seen. Suffice it to say that makers are alert for business, and are likely to carry more orders in the books than they have been. The Continent still remains a customer to a certain extent, and Midland, Scottish and South Wales buyers are placing orders, but mostly on the hand-to-mouth policy. Much hope is expressed that the Ruhr business might get settled and thus allow of the trade getting into more normal lines. There is not a heavy demand for special qualities, but in this department there is a chance of improvement. American business is dull, but this might improve soon if all reports be true.

Iron Ore.

The iron ore trade is dull and several mines are closed. All ore raised is being consumed in the district, as there is at present no outside demand. Foreign ore is being bought, but not in large quantities, and most of it which is imported is stored at the docks.

Steel.

The steel trade continues about the same, with most activity at Barrow, where the rail, merchant, hoop and special small section mills are engaged, as also is the foundry. Not a great amount of orders are held on rail account, but sufficient to keep the mill working most of the week. The Siemens are also at work. In Cumberland there is not much activity in the steel works, but the rail mill has started again for a week or two on an old order held.

SHEFFIELD.

(From our own Correspondent.)

Open-hearth Steel.

SHEFFIELD is still waiting anxiously for signs of a revival in the open-hearth steel trade. This branch has enjoyed a good run for more than six months, and has been almost the only one to show a satisfactory state of activity, but the falling off, which began to be noticeable some six weeks ago, continues unchecked. The resumption of work at the furnaces, on completion of the stocktaking, was on a reduced scale, although a fairly good tonnage is still being turned out, chiefly in connection with old orders. It is the absence of forward buying which is causing anxiety, and the recent reductions in billet prices have failed to stimulate demand. There is little doubt that the present quarter will prove an unsatisfactory one. While there is much pessimism in manufacturing circles, the feeling of confidence in the future has not altogether departed. There is a weakening of continental competition, and a collapse may come about at any time. Not only are outputs on the Continent declining, but prices are rising, and should there be a continuance of this tendency, steel users will be bound to come to this country for their supplies of billets.

Weakness of Steel Scrap.

Although no big cuts are reported, the tendency of pig iron and steel prices is downwards. The weakness of the position is emphasised by the poor demand for scrap, and the very low prices offered. There is practically no sale for this material and the merchants are being called upon for nothing but small hand-to-mouth supplies. Whereas £5 a ton was readily paid for good heavy steel scrap as recently as Easter, the best offers now are 70s. to 75s. No business can be done at such prices, and the dealers are asking 10s. more, at which figure scrap is still cheap as compared with new material. There is very little being done in steel-making alloys, and here again prices are inclined to be easier.

Crucible and High-speed Steels.

In the crucible steel trades conditions are rather better than they have been, although still far from good. A considerable number of small orders continues to be booked, and a few firms are finding fairly regular work possible. As long, however, as the general engineering trades of the country and the shipbuilding yards continue short of work, as they are at present, a general revival of crucible steel is not to be looked for. Compared with the state of things of a year ago, the present sales of high-speed steel show a considerable increase, but surplus war stocks continue to interfere with the demand for new material. There is an improving outlook for nickel and nickel-chrome steels. The twist drill trade is in a very unsatisfactory condition. There is but a poor demand for the high-speed variety, while in the ordinary type the competition of German and Dutch products, at very low prices, is so severe that the bulk of trade has been secured by those countries. The activity of the edge and farm tool trades is well maintained, and some satisfactory orders from the Colonies and South Africa are coming forward. A better sale for spades and shovels is reported, although here again war stocks interfere with the full prosperity of the trade.

Cutlery No Better.

Cutlery manufacturers have very little progress to report, at any rate so far as ordinary lines are concerned. The output of stainless table knives is still on a large scale, but many of the orders go to the small firms whose overhead charges are light, and the old-established large concerns are unable to touch the business at the prices offered. German competition in razors and spring knives is very keen, and is successful in getting the bulk of the business, but many of the pen and pocket knives now coming over from that country are inferior to the pre-war standard of quality. The demand for knives used for trade and industrial purposes is better than that for ordinary domestic lines. Trade in butchers' and shoemakers' knives in particular has been keeping up fairly well on both home and export accounts. The Colonies are the only satisfactory export markets at present.

Cycle and Motor Castings.

The activity in the cycle and motor trades is benefiting the local foundries, especially those which specialise in light castings of the repetition kind. Quite a good amount of employment is being enjoyed by foundries of this class. There is not much demand for larger foundry work, owing to the poor condition of the general engineering trades. There is a fairly good demand for pipe work, while the production of builders' ironwork is providing a useful amount of trade. The motor trade is sending forward a good call, not only for steel, but also for aluminium castings, and a fair amount of activity also prevails at brassfoundries.

A New Local Industry.

Another industry has been added to the long list of those carried on in Sheffield by the W.A.B. Truck and Construction Company, which have started a woodworking factory at Owlerton. The establishment will be used for the manufacture of all kinds of warehouse trucks, barrows, hand carts, ladders and steps, and garden furniture, besides the interior fittings of offices, railway carriages, tramcars, and ships. The factory has been specially built and planned for the work to be done in it and provision is made for future extensions.

Colliery Developments.

The sinking of new collieries goes on apace. At the Harworth pit near Bawtry one shaft has now reached a depth of 780 yards. Water has been encountered, but it has not occasioned any serious difficulty, and it has not been found necessary to install a pump. The Staveley and Sheepbridge companies have got fairly to work with the sinking of their new colliery at Firbeck, a few miles from Worksop. The sinking of both shafts is now down to 15ft., and the chimney has been raised to 31ft. The excavations for the foundations of the permanent buildings have been completed.

NORTH OF ENGLAND.

(From our own Correspondent.)

A Gloomy Outlook.

THERE is no observable improvement in any direction in the trade situation in the North of England. Matters more or less remain in a discouraging and unsatisfactory condition, and the outlook seems as gloomy as ever. In the iron and steel trades, business has sunk to a very low level. Stocks are now accumulating in most branches of the industry, and whilst, as yet, no firms appear to have definitely decided to lay plant idle, such action is being seriously considered, and will doubtless have to be resorted to unless the demand speedily improves. The prevailing uncertain feeling is accentuated by puzzling reports from abroad, and any indication of early movement in the direction of increased activity is difficult to discover. Some gleam of hope, however, is gathered from the view expressed on the Continent that values may advance further, as supplies of any consequence from the German works cannot be looked for, and only limited quantities from Lorraine and the Saar Valley seem likely to be available for distribution, so that orders may be diverted to this country. The position created by the attitude of the boilermakers regarding the question of the overtime and night-shift agreement is rapidly growing worse, and large numbers of men have been paid off this week at several yards on the North-East Coast.

Cleveland Iron Trade.

The dulness in the Cleveland iron trade continues unrelieved. The fall in prices has, so far, failed to stimulate business, consumers being evidently of the opinion that values have not yet touched bottom. This view also influences the export trade, for few of the inquiries coming to hand actually materialise. The position, however, is not altogether hopeless. Production in Belgium and France is very limited, and whilst our prices are falling, theirs are advancing. Thus the scales seem to be slowly turning in favour of the British producer, and they are in a position to meet any substantial expansion in the demand if, and when, it arises. But international conditions are still adverse to trade, and until more settled conditions prevail, no real improvement can be expected. The home demand for pig iron is extremely limited just now. Holiday influences, trade slackness, and falling markets all combine to impose upon buyers a policy of caution, and forward business is entirely out of the question just now, orders simply being placed for urgent needs. The standard No. 3 quality is still quoted at 105s., but the price is subject to negotiation, and could be shaded for substantial quantities. No. 4 foundry is 100s., and No. 4 forge 97s. 6d., while No. 1, which is very scarce, is obtainable at round about 115s. per ton.

Hematite Pig Iron.

The position in the East Coast hematite pig iron trade is much easier. For mixed numbers, 102s. 6d. is an outside figure, and sales for pretty large parcels are reported at well below that figure. The price last January, before the Ruhr occupation, was no more than 90s. per ton. Germany is still buying fair quantities, a number of sales having been effected this week, but otherwise the export demand is very small.

Iron-making Materials.

There is no change in the foreign ore trade, which is extremely quiet, and best Rubio is purely nominal at about 23s. per ton c.i.f. Tees. The coke position is steady, and, if anything, somewhat stronger. Good medium furnace qualities are quoted at about 41s. per ton delivered at the works.

Manufactured Iron and Steel.

There has been a little more business on home account in the manufactured iron and steel trade this week, and the export inquiry is slightly better, but manufacturers are still experiencing some difficulty in keeping their works in operation. Prices are unchanged from last week.

The Coal Trade.

The Northern coal trade is passing through an anxious time, and the immediate outlook is by no means encouraging. Practically all the life and buoyancy have gone out of the market, leaving the situation one of concern for many people. The dockers' strike, with the displacement and delay of tonnage, has aggravated the position and increased the difficulties of the collieries. But when this has been allowed for there is still the fact that the overseas business has fallen away to a considerable extent. Also, merchants with orders and running contracts for abroad are compelled to request postponement for the present, which tends to throw supplies unexpectedly on the market, and to deflate values more than would otherwise be possible. The situation, therefore, is anything but satisfactory, either to colliery or contractor. There are, however, various, and in some cases conflicting, opinions respecting the prospects for the forward market. Many hold tenaciously to the opinion that the present dull phase may be expected to pass off very quickly. Others, however, take a very gloomy view of the position, and are quite resigned to the prospect of a weak and even a lower market for some time ahead. This, however, all remains to be seen. The Northumberland steam coal market is quiet so far as actual transaction of new business is concerned, but the collieries are for the most part fully stemmed, and are not inclined to discount prices to any great extent. Best steams are therefore steady direct, though second-hand men can be squeezed at times. The Durham market is in the main weak and yielding. Best classes of gas coal are nominally steady, but second gas, as well as bunkers, are all slow of sale and negotiable at discounts. One of the most noticeable features of the market is the sudden slump in the demand for coking coal, principally from Germany, which up to a week or so ago was taking large quantities of both unscreened and coking smalls; but though the demand has suddenly ceased, it it quite expected there will be a revival in the near future. Foundry coke, both patent oven and beehive, is firm for prompt, and this applies to all makes of gas coke, which is now very scarce and in good demand.

SCOTLAND.

(From our own Correspondent.)

A Blank Week.

OWING to the Glasgow "Fair" holidays, the past week was one of industrial inaction over the whole district, and with the collieries in all districts also on holiday, trade was practically at a standstill.

A Poor Six Months.

The first half of 1923 cannot be termed otherwise than disappointing. For a time the early promise of better times seemed likely to be borne out, but subsequent events have proved the opposite. High oncosts with accompanying high prices have restricted foreign business, and labour troubles at home have played havoc with the local trade. Raw materials have been almost prohibitive in cost when it was a matter of producing for stock, and demands were so few that even offers of cheaper foreign materials were taken little notice of. The trouble at the shipyards has been a damper on the steel and ironworks and allied trades, and if it had not been for orders booked during the last "boom" period the situation would have been decidedly worse, as establishments would have practically been forced to close down.

Steel and Iron Outlook.

No matter what has happened in the previous half-year, hope is always renewed that after the holidays an improvement may occur. Steel makers have been very short of orders for plates and sections, but a settlement of the dispute at the shipbuilding yards would be of great help towards better conditions. Prices have remained at a high level, but there is little doubt that producers would make an effort to meet consumers were the business offered them sufficient inducement. Sheet makers have all along received a fairly regular stream of export inquiries, sometimes for the heavier gauges, but more often for the lighter varieties, and this has really been the only department to show a measure of steadiness. Bar iron has shown little variation. When new business became short makers made a slight reduction in prices, but it is questionable if the business was really there. At any rate, nothing tangible accrued from the reduction, and chief activities rested in the re-rolled steel departments, where a good steady demand was experienced for tube strips. Of late, however, there has been more apparent movement in foreign markets, and the situation is more hopefully viewed. The future of pig iron is uncertain. The home demand is, of course, ruled by local conditions. This business has been so slow of late, despite various reductions in prices, that it seemed inevitable that some furnaces must be damped down, as producing for stock was far from profitable. Export demands have been irregular, but of late more steadiness has been noticeable. The general outlook is certainly obscured, but makers are alive to the fact that customers are short of stocks and that improving labour conditions would soon mean better demands provided prices were favourable.

Coal.

The coal trade has also been on holiday, but operations are again practically in full swing. The outlook for this industry is quite favourable, and the more so since quotations for round fuel have touched a lower level. Foreign buyers were showing promising activity prior to the holidays, and prospects are bright in this direction. Washed materials have maintained considerable firmness for some time, and there is no indication of any change. Many of the collieries, and particularly in Fifeshire and the Lothians, have a considerable amount of orders on hand, and employment, especially in the former district, is pretty full. Shipments have been heavy, both foreign and coastwise, and there is every prospect of a continuance. The home demands, especially from industrial sources, have naturally been very small, and any movement here can only be in the nature of an improvement.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Position.

THE conditions prevailing in the steam coal trade are exceptionally quiet, and there is no indication that any immediate improvement may be looked for, at least for a few weeks. In the circumstances, the market is keeping up very well, and this can only be ascribed to the fact that collieries are pretty fully sold, and that production is reduced by leave-taking as usual at this time of the year. It cannot be said that the market has any real strength in it, or that prices are upheld as the result of the current inquiry from abroad, because the demand is on very restricted lines. The French Est Railways are in the market for 10,000 to 15,000 tons of steam coals for delivery August–September, but this and other similar enquiries are regarded as of small account on a market that requires a much bigger volume of business to put life into it. The general demand from the Continent is practically stagnant, and until the political and financial conditions become more stable and the foreign exchange rates take a more favourable turn, it is not anticipated that business will show any material expansion. The improbability of prices falling below their present level is supported by the fact that the August holidays are now within measureable distance, and this means the loss of at least half a week's output.

Third-shift Question.

Reference has already been made to the opposition forthcoming from the tippers and coal trimmers to the continuance of the partial third shift which was only secured by the employers after eighteen months' negotiations, and was put into operation at a time when the need for extended working had diminished to some extent. In a statement made by the secretary of the Coalowners' Association, Mr. Gibson points out that the real value of the extra shift lay in the security which it provided for the uninterrupted working of the collieries and for the prompt loading and despatch of steamers. That was, he says, the crux of the matter, but apparently it was being disregarded by the tippers and trimmers, who seemed to have regard only to the quantity of coal shipped at a particular moment. The Cardiff tippers, as a matter of fact, met at the end of last week to discuss the attitude to be adopted to secure an early meeting with the employers to decide what should be done in view of their opinion that the third shift had failed to secure the anticipated expansion of trade. It is understood that the men expressed themselves in favour of the complete discontinuance of the third-shift working. Since then the employing interests have also met and considered the position, and they point out that there is still congestion at some of the ports in this channel, and that the need for the continuance of the third shift is evidenced by facts. Their view is that the extended hours of working should be given a fair trial for the six months originally arranged, and that the men must adhere to the agreement.

Pooling of Wagons.

Some months ago the suggestion was put before the South Wales coalowners by the Great Western Railway Company that it would be advisable to introduce a scheme under which all the wagons employed in the coal trade should be pooled, and their administration centralised. The Great Western Company, seeing that it is in control of the whole of the dock and railway system of South Wales, urged that the pooling of wagons would tend to greater economy and efficiency, both in the working of the collieries and shipment of coal, and that it would not prejudice the trading interests of any particular colliery undertaking. These views, however, are not shared by the colliery owners, and it is understood that within the past few days the Commercial Committee of the Coalowners' Association has definitely informed the Great Western Railway Company that the owners cannot agree to any scheme for the pooling of wagons.

Steel Trade Conditions.

Towards the end of last week a meeting of the Joint Industrial Council for the steel trade was held at Swansea, when the men's representatives submitted ten claims for alterations in conditions and wages, one of them being for an annual week's holiday without loss of wages, while another was for increased rates for locomotive men and shunters. The latter was referred to a committee for investigation, but the week's holiday question, with other claims, were left for discussion at an adjourned meeting of the Council to be held early next month.

Tin-platers' Holidays.

It has been arranged that the annual week's holiday stoppage in the tin-plate trade is to commence on Friday next, August 3rd, at twelve noon to 2 p.m., according to shift, and work will be resumed on Monday, August 13th, at 6 p.m. It is understood that the men have decided to press their request for payment of wages during the holidays at the adjourned meeting of the Industrial Council.

Current Business.

Shipments continue on a very fair scale, but any fresh inquiry from abroad is on a very meagre scale. As a rule, there is heavy loading pressure immediately before holidays, but this can scarcely be said to be the case at present. Middlemen who hold considerable quantities of coal on contract are experiencing some difficulty in placing these coals to advantage, as buyers are reluctant to come along for supplies, especially with the foreign exchanges operating so adversely. Best Admiralty large are nominally 30s. to 32s. 6d., but middlemen are disposed to take materially less than the latter figure, if they can find purchasers. Smalls are also rather more plentiful, except in the case of the superior grades. The patent fuel trade is rather on the quiet side, but coke is steadier, and makers are fairly well sold for their outputs for the remainder of this month and August.

Australian Engineering Notes.

THE Railways Commissioner has invited tenders, closing December 11th, for the construction of 600 steel gondola cars of 40 tons capacity, 500 30-ton box cars, 100 30-ton steel louvred cars, and two wrecking cranes, all of 5ft. 3in. gauge. Specifications will be available at the office of the Agent-General in London on September 4th.

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A SCARCITY of skilled workers and the resistance of the trade unions to overtime are factors facing the building trade in Australia. Plans have been completed in Melbourne for the erection of further large structures, while several theatres and other places of amusement are to be remodelled. The Building Trades' Federation has asked its secretary to inform employers that the Federation will strongly enforce its policy of opposition to the working of overtime. The other problem is the dearth of skilled men and an abundance of unskilled labourers. According to the *Melbourne Argus*, the great activity in the building trade has created an immense demand for skilled workers, and has caused the supply of carpenters, plasterers and bricklayers to become seriously inadequate. Under the respective awards of their trade wages boards, bricklayers and plasterers receive 20s. per day, but competition among builders to obtain their services has resulted in the rate being increased, in some instances, to 30s. and 25s. to 26s. a day respectively. Builders state that the outlook at present is very discouraging, and that some slight relief might be obtained by bringing men from other places. Approximately £100,000 is to be expended on new buildings, principally business premises, in Albury within the next few months. The principal outlay will be on woollen mills and wool stores for the Farmers' and Graziers' Co-operative Wool and Grain Company.

WHEN commenting on one occasion on the anomalies grouping was bringing about, we mentioned that the Midland had a greater financial responsibility for the Forth Bridge than the North British Company, and nearly twice as much as either the Great Northern and North-Eastern. Yet, to-day, the Midland finds itself in the London, Midland and Scottish group, whose route to Aberdeen competes with that by the Forth Bridge. The line taken by the Pullman expresses between King's Cross and Harrogate *vid* Leeds also furnishes interesting anomalies. Westgate Station, Wakefield, is jointly owned by the Midland—now part of the London, Midland and Scottish—and at Holbeck the station and the station at Leeds, Central, and the line between them, are jointly owned by the Lancashire and Yorkshire—also now part of the London, Midland and Scottish—and after the train leaves Leeds for Harrogate it passes at Wortley Junction over a short length of Midland property before getting on to the former North-Eastern metals to Harrogate *vid* Arthington.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	26/-
(1) Spanish	24/-
(1) N. African	24/-
N.E. COAST—	
Native	—
Foreign (c.i.f.)	23/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	5 16 3	—
No. 1 Foundry	5 10 6	—
No. 3 Foundry	5 5 6	—
N.E. COAST—		
Hematite Mixed Nos.	5 2 6	5 2 6
No. 1	5 3 6	5 3 6
Cleveland—		
No. 1	5 15 0	5 15 0
Silicious Iron	5 15 0	5 15 0
No. 3 G.M.B.	5 5 0	5 5 0
No. 4 Foundry	5 0 0	5 0 0
No. 4 Forge	4 17 6	4 17 6
Mottled	—	—
White	—	—
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	13 0 0	—
North Staffs. Forge*	—	—
„ „ Foundry	5 2 6	—
(3) Northampton—		
Foundry No. 3	4 17 6	—
„ Forge	4 9 0	—
(3) Derbyshire—		
No. 3 Foundry	4 17 6 to 5 0 0	
Forge	4 10 0	—
(3) Lincolnshire—		
Basic	5 5 0	—
Foundry	5 2 6 to 5 5 0	
Forge	5 0 0	—
(4) N.W. COAST—		
N. Lancs and Cum.—		
Hematite Mixed Nos.	6 5 0†	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	12 0 0	—
Best „	—	—
N.E. COAST—		
Crown Bars	12 0 0	—
Tees	10 0 0	—
LANCS.—		
Crown Bars	12 0 0	—
Second Quality Bars	11 5 0	—
Hoops	15 0 0	14 15 0
S. YORKS.—		
Crown Bars	12 10 0	—
Best „	13 10 0	—
Hoops	15 10 0	—
MIDLANDS—		
Crown Bars	12 0 0 to 12 10 0	
Marked Bars (Staffs.)	14 10 0	—
Nut and Bolt Bars	11 0 0 to 11 5 0	
Gas Tube Strip	12 10 0 to 13 0 0	

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	13 0 0	—
Ship Plates, ¾in. and up	10 5 0	—
Sections	10 0 0	—
Steel Sheets, 3/16in. to ¼in.	12 10 0	—
Sheets (Gal. Cor. 24 B.G.)	—	18 7 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	10 0 0	—
Angles	9 10 0	—
Boiler Plates	14 0 0	—
Joists	9 15 0	—
Heavy Rails	10 0 0	—
Fish-plates	14 0 0	—
Channels	9 5 0	—
Hard Billets	10 5 0	—
Soft Billets	9 10 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	9 10 0†	—
Light „	12 0 0†	—
Billets	11 0 0†	—
MANCHESTER—		
Bars (Round)	11 0 0 to 11 5 0	
„ (others)	10 0 0 to 10 2 6	
Hoops (Best)	15 5 0	15 0 0
„ (Soft Steel)	13 15 0	13 10 0
Plates	10 5 0 to 10 10 0	
„ (Lancs. Boiler)	13 10 0	—
SHEFFIELD—		
Siemens Acid Billets	13 0 0	—
Bessemer Billets	13 10 0	—
Hard Basic	10 5 0	—
Intermediate Basic	10 10 0	—
Soft Basic	8 10 0	—
Hoops	12 15 0 to 13 5 0	
Soft Wire Rods	13 0 0	—
MIDLANDS—		
Small Rolled Bars	9 15 0 to 10 0 0	
Billets and Sheet-bars	7 15 0 to 8 5 0	
Gas Tube Strip	11 0 0 to 11 10 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	17 15 0 to 18 0 0	
Angles	9 15 0	—
Joists	9 15 0	—
Tees	10 15 0	—
Bridge and Tank Plates	10 5 0 to 10 10 0	

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	23/1½
Block Tin (cash)	177 12 6
„ (three months)	178 15 0
Copper (cash)	65 17 6
„ (three months)	66 12 6
Spanish Lead (cash)	24 12 6
„ (three months)	24 7 6
Spelter (cash)	30 15 0
„ (three months)	30 10 0
MANCHESTER—	
Copper, Best Selected Ingots	70 0 0
„ Electrolytic	73 0 0
„ Strong Sheets	100 0 0
„ Loco. Tubes	0 1 1½
Brass Loco. Tubes	0 1 0
„ Condenser	0 1 2½
Lead, English	26 0 0
„ Foreign	24 15 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/11 per lb.	
Ferro Tungsten	1/5½ per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	10/6
„ 6 p.c. to 8 p.c. „	£21 0 0	8/-
„ 8 p.c. to 10 p.c. „	£20 0 0	8/-
„ Specially Refined		
„ Max. 2 p.c. carbon	£50 0 0	18/-
„ „ 1 p.c. „	£60 0 0	21/-
„ „ 0.75 p.c. carbon	£70 0 0	22/6
„ carbon free	1/6 per lb.	
Metallic Chromium	4/6 per lb.	
Ferro Manganese (per ton)	£18 for home, £20 for export	
„ Silicon, 45 p.c. to 50 p.c.	£13 0 0 scale 5/- per unit	
„ „ 75 p.c.	£21 0 0 scale 6/- per unit	
„ Vanadium	16/9 per lb.	
„ Molybdenum	9/6 per lb.	
„ Titanium (carbon free)	1/1 per lb.	
Nickel (per ton)	£130	
Cobalt	12/- per lb.	
Aluminium (per ton)	£82 to £100	

(British Official.)

FUELS.

	Inland.	Export.
SCOTLAND.		
LANARKSHIRE—		
(f.o.b. Glasgow)—Steam		21/-
„ „ Ell		22/-
„ „ Splint		23-/ to 26/-
„ „ Trebles		26/-
„ „ Doubles		25/-
„ „ Singles		24/-
AYRSHIRE—		
(f.o.b. Ports)—Steam		21/-
„ „ Splint		23/-
„ „ Trebles		26/-
FIFESHIRE—		
(f.o.b. Methil or Burntisland)—Steam		21/- to 24/6
Screened Navigation		30/-
Trebles		27/-
Doubles		25/6
Singles		24/6
LOTHIANS—		
(f.o.b. Leith)—Best Steam		22/6
Secondary Steam		21/6
Trebles		27/-
Doubles		25/6
Singles		24/6
ENGLAND.		
(8) N.W. COAST—		
Steams		31/6
Household		46/6 to 57/6
Coke		48/-
NORTHUMBERLAND—		
Best Steams		26/- to 27/-
Second Steams		24/- to 24/6
Steam Smalls		16/6 to 17/-
Unscreened		20/6
Household		25/- to 28/-
DURHAM—		
Best Gas		27/- to 28/-
Second		24/- to 26/-
Household		25/- to 28/-
Foundry Coke		60/- to 62/6
SHEFFIELD	Inland.	
Best Hand-picked Branch	32/6 to 34/6	—
Barnsley Best Silkstone	26/6 to 28/-	—
Derbyshire Best Brights	25/- to 27/-	—
„ „ House	22/6 to 23/6	—
„ „ Large Nuts	20/- to 21/6	—
„ „ Small „	15/- to 18/-	—
Yorkshire Hards	21/- to 23/-	—
Derbyshire „	20/- to 22/-	—
Rough Slacks	11/6 to 13/6	—
Nutty „	10/- to 12/-	—
Smalls	7/- to 9/-	—
Blast-furnace Coke (Inland)	32/- to 33/-	
„ „ (Export)	f.o.b.	44/- to 45/-
CARDIFF—	(9) SOUTH WALES.	
Steam Coals:		
Best Smokeless Large		30/- to 32/-
Second „ „		28/6 to 30/-
Best Dry Large		29/ to 30/-
Ordinary Dry Large		27/6 to 29/-
Best Black Vein Large		28/- to 29/-
Western Valley „		27/6 to 28/6
Best Eastern Valley Large		27/- to 28/-
Ordinary „ „		26/- to 27/-
Best Steam Smalls		21/- to 22/-
Ordinary „		19/- to 21/-
Washed Nuts		30/- to 32/6
No. 3 Rhondda Large		32/- to 33/-
„ „ Smalls		25/6 to 26/6
No. 2 „ Large		24/- to 25/-
„ „ Through		22/6 to 23/-
„ „ Smalls		16/- to 17/-
Coke (export)		55/- to 62/6
Patent Fuel		33/ to 35/-
Pitwood (ex ship)		32/- to 33/-
SWANSEA—		
Anthracite Coals:		
Best Big Vein Large		50/- to 52/6
Seconds		42/6 to 45/-
Red Vein		30/- to 32/6
Machine-made Cobbles		62/6 to 65/-
Nuts		62/6 to 65/-
Beans		45/- to 47/6
Peas		25/- to 27/6
Breaker Duff		12/6 to 13/-
Rubbly Culm		15/- to 16/-
Steam Coals:		
Large		26/- to 27/6
Seconds		23/6 to 26/-
Smalls		18/- to 22/-
Cargo Through		22/6 to 25/-

(1) Delivered. (2) Net Makers' works. (3) At furnaces. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow.

(8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

* Quotations extremely high and nominal. † Latest quotations available.

French Engineering Notes.

(From our Correspondent in Paris.)

Foreign Exchanges.

ALTHOUGH, in the present state of affairs, the volume of orders being given out in the engineering trades is very small, there are, nevertheless, plenty of inquiries which point to a revival of business when conditions become more favourable, but it is probable that unless the recovery takes place very soon a good many firms will find themselves short of work. The situation is, of course, adversely affected by the holiday season, as well as by the reluctance of buyers to place orders at a moment when the political outlook appears to be very uncertain; but as there is, generally, a feeling of confidence in the future, the engineering trades are waiting in the expectation that the holiday season will be followed by a recovery due to the clearing away of international complications. Meanwhile, it cannot be said that the French industry is suffering so much as had been expected from the complications. There is no serious lack of employment, and the efforts that have been made to ensure supplies of raw material to make up for the deficiency from the Ruhr are having a marked effect upon the foreign trade, which has been developing in a satisfactory manner. During the first six months of the present year there was only a small excess of imports over exports, so far as values were concerned, though as the values of exports are assessed according to an arbitrary standard they cannot be regarded as representing the actual value of the business done. While there was a fairly even balance of trade in values, the tonnage showed that the imports more than doubled the exports, this being due, largely, to the purchases of coal and other raw material. The imports totalled 25,691,325 tons, or 1,254,554 tons in excess of the amount for the first half of last year. The exports amounted to 11,399,567 tons, an increase of 1,610,201 tons. The weight of manufactured goods exported was about double the imports, while the value was nearly quadrupled. This satisfactory development of foreign trade is, of course, largely attributable to the contribution of the manufacturing resources of Alsace-Lorraine. The returns are also interesting as showing the importance of Great Britain as a market for French raw material and manufactured goods. Britain takes more from France than any other country, and its consignments here, although of less extent, are, nevertheless, sufficiently great to prove the necessity of developing commercial relations between the two countries.

Stainless Steel.

Some French firms having put stainless steel cutlery on the market, proceedings were taken against them a year ago by the owners of the Brearley patents, who obtained judgment against them first at Havre and then at Rouen. The verdict aroused great indignation amongst the steel firms, which could not understand why a national industry should be made tributary to a foreign patent. Numerous protests have been made from time to time, and it is now stated that several of the leading steel concerns have combined to fight the Brearley patents and decide, once and for all, whether the home industry is to be shackled by a foreign monopoly. They have collected all possible data with a view of proving anticipations, particularly by publications in the technical Press, and it is evident that the struggle will be carried out to the bitter end. Meanwhile, they are giving a guarantee to their cutomers indemnifying them against any action for damages that may be taken by the holders of the stainless steel patents.

A Floating Exhibition.

The productive capacity of the country has been so enormously increased during the past few years that it is becoming more and more necessary to find markets abroad for a surplus output. Not only have French makers to dispose of essentially national products, such as wines and silks and feminine attire, but they have embarked so extensively on many branches of the engineering industry, such as agricultural machinery, for example, that they are unable to compete in the home market except by a mass production, which means that they must sell considerable surplus supplies abroad. The foreign markets are, therefore, becoming more and more necessary to them, and a first step towards popularising French goods abroad was the sending of three cruisers on a tour with samples of products and everything necessary for carrying on propaganda work at the ports of call. The ships have now returned, and the results are said to be so far satisfactory that another experiment is to be carried out with a 12,000-ton ship which has been supplied by the Government to a committee formed to equip it as an exhibition. After being overhauled at Dunkirk the vessel is now at Rouen, where it is being fitted up with stands and showrooms. When completed it will start on a seven months' cruise to South America.

Ferro-concrete.

The fortunes of reinforced concrete vary so much with the values of iron and steel that it is curious to observe the fluctuating popularity of that material. After losing ground at a time when there was an abundance of structural steel, reinforced concrete is now enjoying a remarkable vogue, and steel alone is only employed for light constructions. Since the occupation of the Ruhr iron and steel prices have more than doubled, and have reached a point which leaves a large margin in favour of reinforced concrete. In the extensive works being carried out on the State railways between the Batignolles and Colombes, concrete is employed almost exclusively in the construction of platform roofs, stairways and sheds; in fact, except for one platform roof and the signal bridges, practically the whole of the work is in concrete. Other remarkable structures are the two airship sheds being constructed at Orly. They are probably the largest single-span concrete buildings in the world. Each shed is 984ft. long, 298ft. 6in. wide, and 194ft. 6in. high. It is built up of forty spans 9ft. 9in. depth at the keystone, and 24ft. 8½in. wide.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

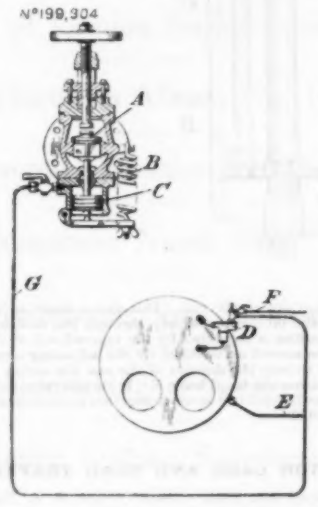
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

199,304. September 20th, 1922.—FEED WATER CONTROL, The Aster Engineering Company (1913), Limited, Wembley, Middlesex; and W. Smith, Bruce Cottage, Byron Hill-road, Harrow-on-the-Hill.

This control apparatus acts on the inlet valve of the feed pump. The valve A is held off its seating by the spring B lifting up the plunger C. The feed pump will not then deliver any water, which will surge back and forth through the valve. If the water level in the boiler falls below a predetermined limit the device

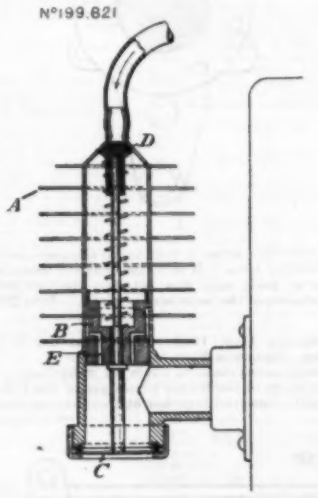


D closes a valve which otherwise puts the pipe E in communication with the waste F leading to the hot-well. When this valve is closed water under boiler pressure goes by way of the pipe G to the top of the piston on the plunger C and overcomes the tension of the spring B. The valve A is then free to act as a non-return valve and the pump supplies water to the boiler. When the water level is regained E is opened to the waste drain again, the pressure above the piston of C is released and the spring holds up the valve again.—*June 21st*, 1923.

INTERNAL COMBUSTION ENGINES.

199,621. July 18th, 1922.—A SAFETY DEVICE FOR WATER JACKETS, G. E. Jonsson, Halmstad, Sweden.

For the purpose of preventing the water jackets of motor car engines being damaged by the freezing of the water they contain, the inventor arranges the device shown in communication with the jacket. It is provided with a number of gills A to

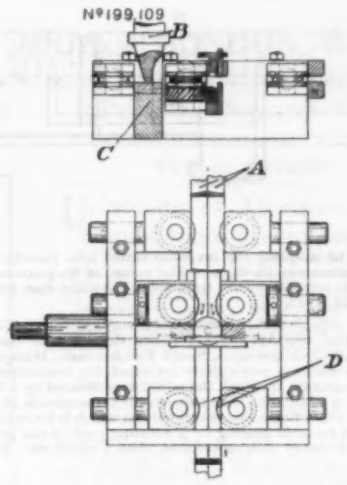


facilitate the dissipation of heat in advance of the loss from the water jacket, with the result that it will freeze up before the jacket. When the contents freeze, the plunger B is forced downwards, breaks the glass diaphragm C and allows the water in the jacket to escape. In normal working a small circulation of water is maintained through the apparatus, past the valve D and through the passages E.—*June 28th*, 1923.

DYNAMOS AND MOTORS.

199,109. March 13th, 1922.—IMPROVED METHOD OF AND APPARATUS FOR PRODUCING COMMUTATOR BARS, Stanley John Watson and Arthur Orbel Hinchliff, of 38, Webbs-road, Battersea.

According to this invention commutator bars for electric motors and generators are produced by feeding the blanks in the form of a strip or strips intermittently to a power press or swaging machine and pressing the blanks between tools so shaped as to produce the desired cross section, the strips afterwards being cut up as desired. The bars A of suitable material and substantially rectangular in cross section are fed side by side through the machine in the direction of the arrow. The feeding apparatus is secured to the table of the press and the tool B is clamped to the reciprocating portion of the press, the bars A to be worked being passed over the anvil C and swaged or compressed between

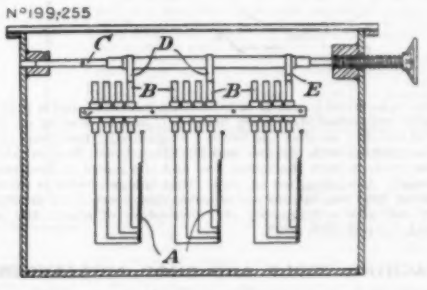


it and the tool. The bars A are guided by means of two pairs of grooved rollers D positioned in front of and behind the swaging tool B. When the bars are fed singly into the press the tool is formed with a single taper, but when two bars are fed in together the tool is formed with a double taper.—*June 13th*, 1923.

SWITCHGEAR.

199,255. June 20th, 1922.—IMPROVEMENTS RELATING TO ELECTRICAL TRANSFORMERS, Alfred George Ellis, of Thorncliffe, Lisson-grove, Hale, Chester, and the Metropolitan-Vickers Electrical Company, of 4, Central-buildings, Westminster.

The transformer is of the three-phase star connected type and comprises phase windings A arranged within a casing in the usual

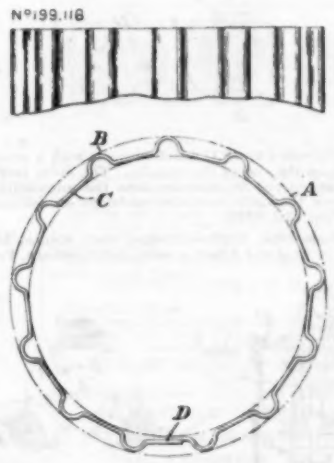


manner, the regulating switch comprising three groups of fixed contacts B of any convenient type mounted on an insulating support, and a rotatable shaft C carrying three contact fingers D adapted to co-operate with the groups of contacts B. The shaft C has a screwed portion E at one end and is mounted at opposite ends in a bushing.—*June 21st*, 1923.

TRANSFORMERS AND CONVERTERS.

199,118. March 14th, 1922.—IMPROVEMENTS IN ELECTRICAL INSULATING CYLINDERS, Arthur Percy Morris Fleming, of West Gables, Hale-road, Hale; B. S. and W. Whiteley, Limited, of Pool Paper Mills, Pool near Leeds; and the Metropolitan-Vickers Electrical Company, Limited, of 4, Central-buildings, Westminster.

This invention relates to electrical insulating cylinders and in



particular to barriers of sheet insulating material for separating the windings of electrical transformers. In the form illustrated the member A is of general cylindrical formation, having a series of longitudinal corrugations united by flat portions C. The barrier is formed of a sheet of insulating material having its edges united by a lapped joint D.—*June 14th*, 1923.

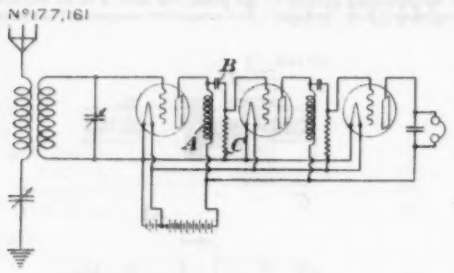
TELEGRAPHS AND TELEPHONES.

177,161. March 14th, 1922.—IMPROVEMENTS IN OR RELATING TO THERMIONIC VALVE AMPLIFIERS, John Millon Millar, the Naval Radio Research Laboratories, Bureau of Standards, Washington, U.S.A.

This invention relates to an amplifying system with couplings

composed of a high inductance A in the neighbourhood of half a henry, and a low electrostatic capacity B in the neighbourhood of two and a-half microfarads. C is a high resistance. With

N°177,161

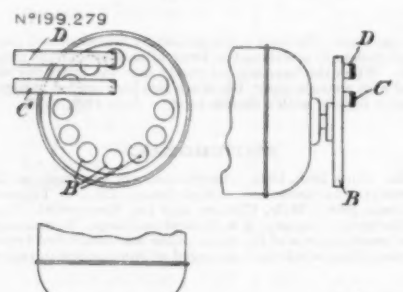


this form of coupling the inventor states it is possible to get good amplification throughout the range of frequencies corresponding to wave lengths of from 200 m. to more than 20,000 m.—*June 14th*, 1923.

199,279. April 30th, 1923.—IMPROVEMENTS IN WIRELESS SYSTEMS AND APPARATUS, James Robinson, of the Royal Aircraft Establishment, South Farnborough, Hampshire.

This invention is particularly intended for transmitting sets as used in aircraft, in which the power is generated by a dynamo driven by a windmill. The tonic train transmission is accomplished by providing a rotary interrupter which is driven directly or through suitable gearing by a rotating part of the generator itself. The rotary interrupter comprises a metal disc A having

N°199,279



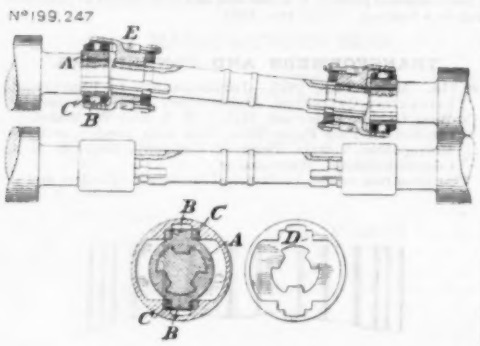
twelve cylindrical insets B of insulating material, and a pair of suitably supported stationary brushes C and D bearing on one face of the disc, so that one brush C continually maintains electric connection with the disc and the other brush D alternately makes contact with the metal disc and the insets of insulating material. Assuming, for example, that the generator is driven at about 3000 revolutions per minute, this direct drive arrangement will give a frequency of interruption of about 600 per second.—*April 30th*, 1923.

MACHINE TOOLS AND SHOP APPLIANCES.

199,247. June 10th, 1922.—ROLLING MILLS, Davy Brothers, Limited, Park Ironworks, Sheffield, and T. W. Hand.

In this universal spindle for rolling mills the flexible joint is provided by a trunnion block A which is fixed on the end of the roll arbor. The trunnions are shown at B B. On each trunnion

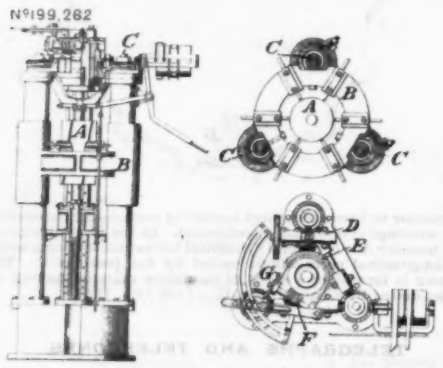
N°199,247



there is a flat-sided block C which engages with a groove D in the muff E on the end of the spindle. The outer faces of the blocks C are curved to accommodate the angularity of the spindle, while the muffs can slide endways on splines on the spindle.—*June 21st*, 1923.

199,262. June 28th, 1922.—FLUTING MILL ROLLS, L. Praeg, corner of Smal and Albert-streets, Johannesburg, Transvaal.

N°199,262

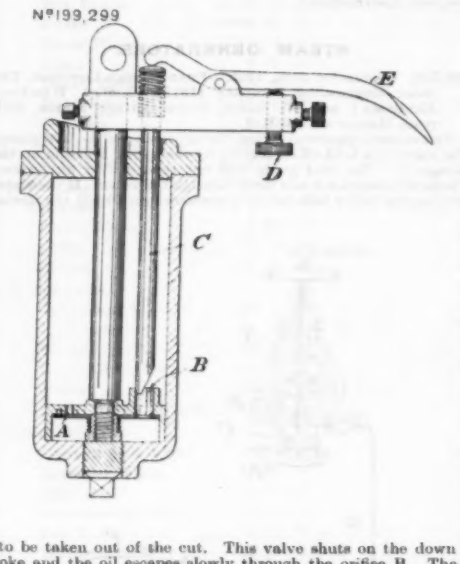


This machine is intended for fluting the rolls of grinding mills. The roll A is centred between the three columns of the machine, on which the tool carriage B slides. A vertical reciprocatory movement is given to the carriage by the screws C C C, and it is provided with grooving tools. The worm gear D and quadrant E are used to rotate the roll partially, so that the grooves shall be helical, while other worm gear F and a ratchet G move the roll round, step by step, for the successive cuts.—*June 21st*, 1923.

199,299. September 7th, 1922.—HACK SAW DASHPOTS, E. G. Herbert, Atlas Works, Chapel-street, Levenshulme, Manchester.

With this dashpot it is possible to control the speed of descent of the saw frame without disturbing the adjustment for the normal cutting feed of the saw. The dashpot piston has a light plate valve A, which allows it to be lifted quickly when the saw

N°199,299



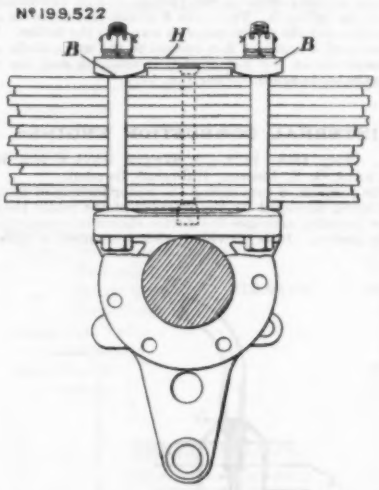
is to be taken out of the cut. This valve shuts on the down stroke and the oil escapes slowly through the orifice B. The size of this orifice is regulated by the tapered end of the rod C, which can be moved up or down by the adjusting screw D. If it is desired to stop the descent of the saw the orifice B can be closed by raising the hand lever E. It should be noted that the rod C and the dashpot piston move together in normal working.—*June 21st*, 1923.

MOTOR CARS AND ROAD TRAFFIC.

199,522. April 5th, 1922.—SPRING CLIPS, J. I. Thornycroft and Co., Limited, Smith-square, Westminster, and V. G. Barford.

In order to reduce the liability of the bolts used for clamping

N°199,522

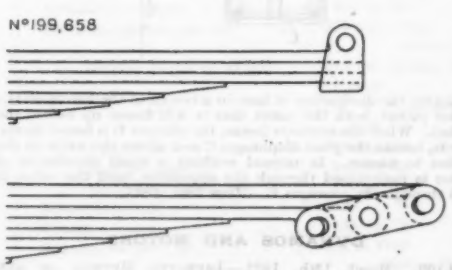


leaf springs on to the axles of vehicles to fracture, the inventors make the "strong back" H with two narrow seatings B B, so that the spring leafs may flex between the gripping points, so that the bending of the bolts is minimised.—*June 28th*, 1923.

199,658. October 17th, 1922.—LEAF SPRINGS, J. H. Stott, Glen May, Osmaston Park-road, Derby.

In this specification claim is made for a laminated spring, in which two or more of the longer plates are of the full length of the spring, and connected together at their extremities, so as to

N°199,658



offer combined resistance to torsion, rebound beyond the unloaded position and side motion by means of a stirrup link or links pivotally connected to a spring or an unsprung part by using only one anchorage pin for each stirrup link, so as to avoid any wedging action between such plates, substantially as illustrated in the figures.—*June 28th*, 1923.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

FRIDAY AND SATURDAY, JULY 27TH AND 28TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Council Chamber, The Exchange, Market-place, Nottingham. Friday, 10.45; Saturday, 9.30. For programme see page 58.

SATURDAY, JULY 28TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—North-Eastern District meeting in the Guildhall, York. 3 p.m.

CONTRACTS.

THE HAMWORTHY ENGINEERING COMPANY, Limited, of 70, Victoria-street, Westminster, has recently received an order from H.M. Office of Works for two air compressors, driven by 25 horse-power motors, for installation in the House of Commons.

CLAYTON AND SHUTTLEWORTH, Limited, Lincoln, have been successful in securing an order for two of their "Clayton" sectional type boilers from the Electricity Department of the Tunbridge Wells Corporation. In addition, they are executing contracts for very large boilers for, amongst others, the London County Council, Yorkshire Electric Supply Company, London, Midland and Scottish Railway Company, and the Frodingham Iron and Steel Company, Limited.

THE scheme of Edmond Coignet, Limited, for the construction in reinforced concrete of the new General Post Office building at Singapore has been accepted by the Crown Agents for the Colonies, who have appointed the firm to prepare the working drawings and all the necessary particulars for the construction of the building. The general architectural design is by Major P. H. Keys, D.S.O., F.R.I.B.A., of Singapore. The new building, which will be six storeys high and will be carried on a reinforced concrete raft foundation, will stand in a triangular site. The principal façade will be 400ft. long, the two others being about 300ft. each.

THE board of the South-Eastern and Chatham Construction and Power Company, Limited, has intimated to the English Electric Company, Limited, Queen's House, Kingsway, and to the Metropolitan-Vickers Electrical Company, Limited, Trafford Park, Manchester, that their two tenders for motors and control gear respectively have been accepted. These equipments are required for the electrification of the first section of the South-Eastern and Chatham Division of the Southern Railway, and will cover the conversion to electrical operation of the suburban services within a 15-mile radius of Charing Cross. The equipments consist of 508 traction motors, each of 300 horse-power, with the appropriate controlling apparatus. The two contracts are possibly the largest for multiple unit equipments for main line railway electrification which have ever been placed.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MR. G. F. ROBERTSON, M.I. Mech. E., Craiglea House, Polmont, Stirlingshire, who for the last ten years has been superintending engineer for Carron Company, Falkirk, is shortly severing his connection with that firm to take up an appointment with Jute Industries, Limited, Dundee.

BROWETT, LINDLEY AND CO., Limited, of Patricroft, ask us to announce that their works and offices will be closed for the annual holidays, 1923, from Friday evening, July 27th, until Tuesday morning, August 7th. No goods can be received or dispatched during that time, but a small staff will be retained to deal with urgent matters of correspondence.

THE INSTITUTION OF AUTOMOBILE ENGINEERS.—We are asked to announce that on and after Wednesday, August 1st, the address of the Institution of Automobile Engineers will be Watergate House, York-buildings, Adelphi, W.C. 2. The new offices occupy the whole of the second floor of Watergate House, overlooking Victoria Embankment Gardens, and are within two minutes' walk of Charing Cross Stations.

THE PUBLIC WORKS, ROADS AND TRANSPORT CONGRESS AND EXHIBITION.—A Public Works, Roads and Transport Congress and Exhibition will be held from November 22nd to 29th next at the Royal Agricultural Hall, London, N. The arrangements for it are in the hands of the Congress Organising Committee, of which Sir Henry P. Maybury, Director-General of Roads, is chairman, and which is comprised of representatives of the Ministry of Health (*ex officio*) and all the principal associations of local authorities, public bodies and their officials, the object being to provide an opportunity for the discussion of the many problems which confront those who are responsible for the administration of the public services. The Congress will be attended by officially appointed representatives from local authorities and other public bodies throughout Great Britain, whilst the attendance of a considerable number of representatives of the Self-governing Dominions is anticipated. Practically the whole of the available exhibition space in the Royal Agricultural Hall has, it is announced, already been booked by firms specialising in materials, machinery, plant and vehicles used in connection with public works and municipal undertakings.

BRENT STATION.—Brent Station—the first station on the new extension line from Golders Green to Edgware, which is rapidly approaching completion—is something entirely new in the way of Underground station buildings. It is designed in Georgian style and will harmonise well with its rural surroundings. Approached by a broad macadam forecourt, the station consists primarily of a large booking hall, 50ft. square, entrance being effected through a Portland stone portico formed of coupled Doric columns. A touch of colour will be given by the use of sand-faced bricks of varying tones of red and purple, which will contrast very pleasantly with the white stone of the portico. The roof is covered with Italian tiles, and has wide projecting eaves. The booking hall floor is covered with large black and white non-slip tiles, and the walls are also tiled out in panels to provide neat spaces for advertisements, thus preventing the disfigurement of the station by the haphazard posting of bills. The platforms being about 15ft. above the level of the roadway, the trains are approached from the station through a short subway under the viaduct, and then up a flight of stairs on to the platforms. The booking hall will be equipped with three of the latest pattern passimeter booking booths, constructed in oak and harmonising with the booking hall.